THE MODEL ENGINEER

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The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

8TH JUNE 1950 VOL. 102 NO. 2559

SMOKE RINGS

Our Cover Picture

● INDUSTRY STILL feels the shortage of skilled craftsmen, and many engineering firms are taking steps to remedy this deficiency by the promotion and encouragement of training schemes for apprentices and students. Our picture shows an apprentice in the works of Messrs. Unicam Instruments (Cambridge) Ltd., being initiated into the mysteries of gearcutting. The machine illustrated is a Pfauter gear hobber, capable of cutting spur, helical or worm gearing up to a maximum diameter of 12 in., with a range of teeth from 8 to 360 in number. It generates the teeth on the blank carried on the vertical spindle by means of a hob, carried on the spindle at the rear, which is adjustable to suit the angle of the gear teeth. Gears may be cut either singly, or in banks up to 3 in. or 4 in. thick. In the course of apprentice training at the above factory, boys are taken on at the age of 15 and placed on one year's probation. If found suitable, they are then apprenticed for five years, during which they receive a thorough training in the use of all machine tools, including centre lathes, capstans, millers, grinders, etc., also in the use of hand tools, fitting and assembly work, all to fine tolerances, qualifying eventually as highly skilled instrument makers. This picture was submitted by Mr. Edward Leigh, of Cambridge.

From the "M.E." Exhibition Manager

● OUR MR. E. D. STOGDON, who is now very busy with his preparations for the forthcoming "M.E." Exhibition has asked us to publish two requests on his behalf. The first is that he would be glad to hear from anybody who is willing to contribute a model to the Loan section. These exhibits should be of outstanding interest, intrinsically or historically, and ineligible for the general competition.

Secondly, a number of stewards will be required during the period of the exhibition. Any individual model engineers, or member of a model engineering club would be welcome. The duties will include unpacking and positioning of the exhibits, guarding them while the exhibition is open to the public, and repacking them when the exhibition is over.

If anyone is able and willing to help in either or both of these requests, will he please communicate as soon as possible with the Exhibition Manager, Percival Marshall & Co. Ltd., 23, Great Queen Street, London, W.C.2.

A Reminder to Photographers

● WE WOULD remind our photographic readers that we are always searching for photographs which can be used as cover pictures. The prints should be of upright shape and of such proportions that they can easily be reproduced to the 6 in. width and 9 in. height of our cover.

The photographs should be of a striking character, attractive in effect and, preferably, of a model in action, though good shots of prototypes are acceptable. One point which wants carefully noting is that the subject should be fairly low on the print, so as to avoid interference between details and the title of our magazine ; it is not always easy to avoid an unsatisfactory effect being produced by the title being mixed up in, for example, the topmasts and rigging of a ship.

With the summer months upon us with their attendant abundance of outdoor events (weather permitting), there should be some opportunities of taking suitable photographs of striking and unusual subjects—the more unusual the better, so long as they are within our scope.

News from Sydney, N.S.W.

● IT IS a long while since we heard from our friends of the Sydney Society of Model Engineers, away " down under " in Australia, and we were very pleased to receive a letter recently from Mr. R. R. Steward, the hon. secretary. He enclosed a copy of the May issue of the society's bulletin, and from it we are interested to learn that, on April 15th last, the society celebrated its forty-second birthday ; we wish it a belated but none the less sincere " Many Happy Returns."

Mr. Steward says that the Sydney S.M.E. still claims to possess the only exhibition park in the world to cater for all types of model engineering ; the amenities include : A 54-ft. concrete track for race cars ; a 70-ft. pond for speed boats and " prototype " model ships ; an 800-ft. 2½-in. gauge locomotive track, now being rebuilt ; a multiple-gauge track, now being relaid, to suit locomotives from 3½-in. gauge to 8 in. gauge ; a steam boiler and powerhouse for stationary models ; an 800-ft. " O "-gauge electric track ; clubrooms and workshops.

This is a formidable list, and we must say that we do not know of its equal anywhere else, though we are aware that there are some model engineering societies which can claim some 75 per cent. or so of these amenities available. There are, of course, many societies with *hopes* of possessing a complete range of facilities like those in Sydney. The main difficulties, in Britain at any rate, are bound up in the scarcity of suitable sites and the regular manning of such establishments, not to mention the expenses involved. Conditions in other countries are different, however, and where clubs are able to make satisfactory arrangements as to the acquisition of land, erection of buildings, making of tracks and ponds, the maintenance of the equipment, as well as the necessary personnel to keep things going, the establishment of such parks as that of Sydney is always an attractive proposition. Our friends in Australia are fortunate, indeed, and judging from the contents of their bulletin, the energy and enthusiasm they put into the hobby, in all its branches, are such as to ensure that full advantage can be taken of the copious amenities provided in the exhibition park.

Hull's Third Exhibition

● WE HAD an opportunity of looking round the third exhibition organised by the Hull and District Model and Experimental Engineers Society, and we found it very interesting and enjoyable. There were no fewer than 107 exhibits in the nine sections of the competition, and 37 loan exhibits. Among the locomotives there was a 5-in. gauge G.N.R. Stirling 8-ft. single-wheeler, of which the wheels, frames and boiler were almost finished ; but they are really to scale and show such careful construction and attention to detail that, when the engine is finally completed, it will be, without doubt, one of the most satisfactory replicas of its very popular prototype ever made. Among the ships—unexpectedly few in number, but all very good—we particularly admired a model of the four-mast barque, *Archibald Russell.*

A most unusual piece of work was a 1½-in. scale farm binder, a working model which is correct in every detail. Scientific apparatus included two very well made 35 mm. cameras, a type of exhibit not very often met with.

There were several excellent and interesting stationary engines of various types ; and we were rather intrigued by two " Seal," four-cylinder petrol engines, both alike, to all appearances, but one was half the size of the other !

Finally, we found our attention strongly attracted to a collection of seven models loaned by Messrs. Rose, Down & Thompsons Ltd. and representing examples of early oil mill machinery ; all were nicely made of wood and were the work of an old craftsman over 80 years of age. They comprised : An early post mill, a Watt " sun-and-planet " engine, a " grasshopper " engine, a diagonal engine, a Herbert lever press, a water-mill and an Anglo-American mill.

Variety was a strong feature of the whole show, in every department, and there was a welcome display of old and historically interesting models illustrating the development of colliery winding gear over a period of about 160 years.

Two Beam Engines Condemned

● THE NUMBER of beam engines now working in the British Isles cannot be very great, and there is probably only a short time to wait before the last one ceases to function. Two such engines built, respectively, in 1857 and 1867, and installed in the Glasgow works of Messrs John Lean & Sons Ltd., are, we learn, shortly to be replaced by power plant of more modern type.

We hope that there is, among our Glasgow readers, somebody who would be able to make arrangements to see that as much information as possible shall be preserved regarding these two old engines. Dimensions and other particulars obtained with a view to the preparation of detailed drawings, together with photographs of the principal details, would be the kind of information which would earn the gratitude of present and future enthusiasts.

*AMATEUR FOUNDRY WORK

A Model Engineer's Record of Failures and Successes

by A. L. Headech

A FIRST-CLASS means of melting metals such as aluminium, brass, gunmetal and bronze, is the centrifugal laboratory furnace sold by Messrs. Fletcher, Russell & Co. Ltd., Palatine Works, Warrington. (Fig. 17*a*.) They are obtainable in several sizes, the most useful for model engineers being the No. 6 which uses crucibles $5\frac{3}{4}$ in. $\times$ 4 in. inside measurement. These are large enough for a great variety of castings. An air blast of 2 lb. per sq. in. is needed, preferably from a disc-type blower. I have melted phosphor-bronze in just over the hour in one of these furnaces. It has been in use now for at least five years and is still very efficient.

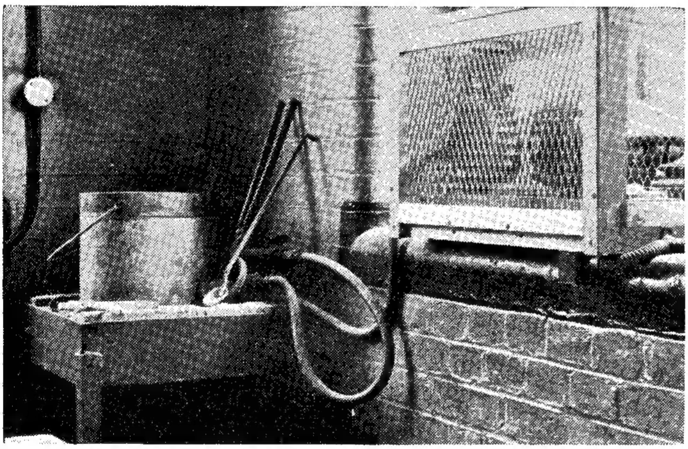
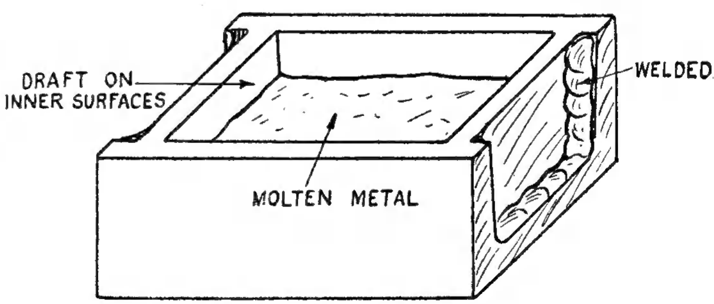


Fig. 17a. Crucible furnace used by the author. Note blower and motor on right. (Photo by kind permission of the headmaster, Wimbledon Technical School for Boys)

Messrs. Fletcher Russell & Co. Ltd., inform me that their furnaces are sold only for laboratory, experimental or educational purposes. They are not to be used in connection with any commercial or industrial process.

As model engineers, are usually very interested in experimental work and much of their labours come under this category and could be said to be educational as well, I feel that some readers who would like to purchase one of these furnaces might approach the firm along these lines. They have been very helpful, and I feel sure will deal sympathetically with readers who desire advice.

The furnace should be lit, and allowed to get thoroughly heated with the crucible inside, before the broken pieces of metal are inserted. Any molten metal remaining in the crucible after pouring, should be run off into an ingot mould. If this is not done, a cracked crucible is likely to result, since there is a difference in cooling rate between the metal and the crucible material. The ingot mould may be made from channel iron, the ends being formed by inserting plain pieces to make a box, and welding them into place, Fig. 18. This work could be done by a friend " in the trade," or put out to a welding firm. Other means could be used to secure the ends which will no doubt occur to the model engineer. In fact, any box-like shape with internal draft incorporated will suffice as long as it will resist the heat of the molten metal. The inside surfaces should be coated from time to time with plumber's black to prevent the ingot adhering to the box.



Right—Fig. 18. Ingot mould

It always gives me a feeling of satisfaction when I see a casting for an i.c. engine or a model

*Continued from page 737, " M.E.," May 25, 1950.

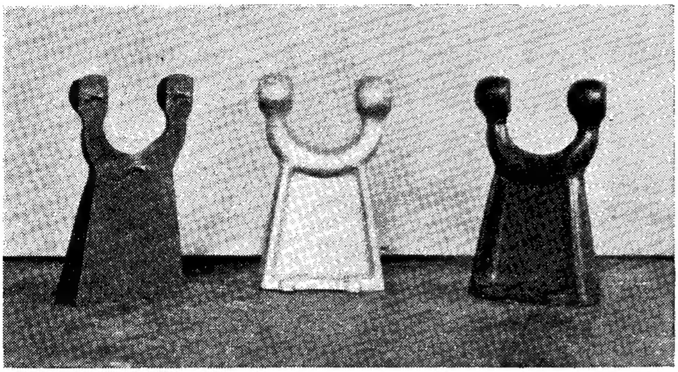


Fig. 19a. A parted pattern and aluminium casting for a polishing head. Note locating dowels. (Boys' work)

steam locomotive which was the result of the home foundry, and equipment made up in the workshop, and above all produced from a handful of scrap metal.

Moulding Practice

I hope from the foregoing information that the way has been cleared to enable those interested to attempt their first non-ferrous casting. The details on making a sand mould will, in the main, be applicable to the majority of castings required by the model engineer. Where points will

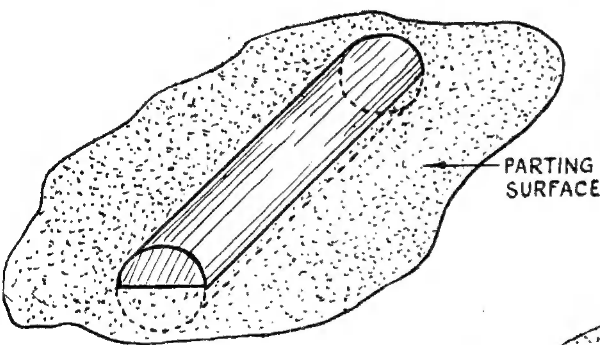


Fig. 19. Pattern requiring horizontal casting

differ, will be in the particular shapes of patterns which will necessitate certain modifications of procedure during the making of the mould. For example, a pattern of cylindrical shape will require to be moulded having half in the cope and half in the drag. That is, of course, if the pattern is much longer than it is in diameter, Fig. 19. Other shorter objects can be cast vertically, with perhaps the larger portion in the drag and a small projection into the cope. Small castings are usually made from a one-piece pattern, whilst larger work will call for a parted pattern. In the casting of the model aero engine crankcase mentioned at the beginning, considerable difficulty was encountered in obtaining a clean, smooth impression in the sand. I knew nothing of the "oddside" method of making a mould at that time, and tried to obtain a smooth finish by repeatedly removing the pattern from the drag and filling up voids with damp sand, and carefully replacing the pattern and gently tapping it down to the level of the parting line. As patience is one of the usual characteristics of a model engineer, I eventually succeeded in making a clean mould. It was not until much later, that the oddside method was explained to me, which I will describe in due course. It will be understood that the placing of the pattern on the moulding board at the beginning of a mould can only apply to patterns which by their very shape lend themselves to this method (Fig. 11), generally those having a flat base or surface from which the rest tapers upwards. Rounded patterns which are parted and located with dowels conform to this method. The side of the parted pattern having the sockets is the one which is laid on the moulding board. The inverted drag is placed over it and filled in the usual manner, and rolled over. The cope half of the pattern having the pins is then located, and the rest of the mould filled. (Fig. 19*a*.)

"Oddside" Moulding

In the case of the crankcase pattern the drag was filled and rammed and levelled off. A small recess was made with a trowel and the pattern pressed into the hollow and made good with sand around it. The depth to which the pattern was pressed was governed by the lugs on the crankcase, Fig. 20. It can be seen that this way of obtaining

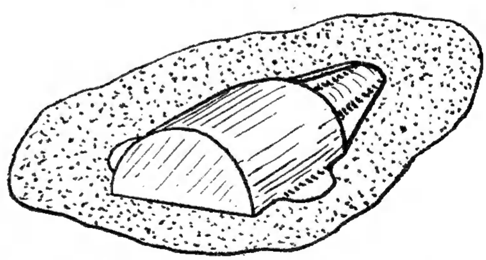


Fig. 20. Pattern lying on centre-line in drag-half of mould

the drag impression is poor, as it is extremely difficult to ram around the pattern evenly once it is inserted. The remedy lies, therefore, in the use of an "oddside." Take the cope half of the flask, and place it on the moulding board with the pins uppermost. Fill with sand, ramming the while until full. Strike off the surface and see that it is smooth and flat. Now scoop out a small hollow and place the pattern

round side downwards into it, and make good around with damp sand. The result will be as in Fig. 21. Dust the top surface of the cope with parting sand and place the drag into position. Now sieve moulding sand over pattern and around to a depth of 1½ in. and add more sand by hand, spread evenly and ram in the usual

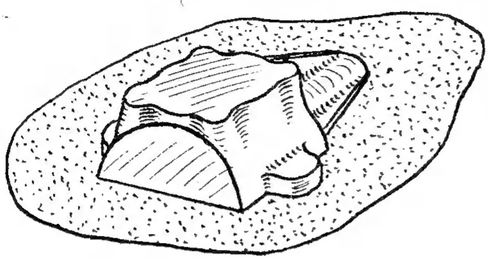


Fig. 21. Pattern resting in cope

manner. Level off the top of the sand, make vents, and place the bottom board on top and roll the flask over. You will see that the drag is now in its right position. Lift off the cope carefully and the pattern will now be seen cope face upwards (Fig. 20) as before. Remove sand from cope half of the mould, dust the surface of the drag, replace cope, put in sprue and riser pins and fill up mould in the usual manner. By this means a good impression will be certain, and the ramming will be evenly distributed around it.

It was in the casting of this particular job that I learned the lesson of large sprues. The first attempt produced a shrunken casting which would not hold up to the outside diameter required. The lower half of the crankcase was less than the correct radius by nearly ⅛ in., Fig. 22. After several attempts at various temperatures had been made, to no avail, I tried enlarging the sprue—the original being some ¾ in. in diameter. This was increased to over 1 in., and the result gave all that could be desired, a full impression, and a casting that could be fully machined. Flat surfaces of large areas can often give trouble in this way. Another fact to remember is that the metal in the sprue must at least be equal to the volume of metal in the casting. I saw some years ago at an exhibition some commercial castings, these were of thin section and full of fine detail and the sprue was still attached to some of them. It seemed out of all proportion in size, being a piece of metal 6 in. in length and a good 2 in. in diameter. This proved conclusively the facts I learned a year or two before.

Casting Proportions

When designing a casting one should aim at even thicknesses as much as possible, so that the cooling of the metal after pouring will be at a constant rate over the entire casting. A large isolated mass should be avoided, as it cools last of all and contracts below the required dimensions, often with a hollow surface. These parts are better cored from underneath to keep the wall thickness in proportion to its surroundings. Where a mass is unavoidable owing to the design, two methods are open to trial. One is to arrange a large riser or feeder above this portion of the casting so that the metal over it cools last, thus keeping the impression in the sand full, Fig. 23. Secondly, a "chill" can be placed against that portion of the casting before it is poured to accelerate the cooling at that point. A chill is a cast-iron bar or block which is inserted, of course, at the time of moulding.

Cores

The foregoing suggestions have been intended for the help of the raw beginner who has wished to produce castings of a simple character without cored recesses or intricate shapes. As even the simplest form gives a satisfying reward on completion, so to a greater extent does the execution of the more difficult examples. It was some time before I could bring myself to attempt cored castings requiring a core box, core prints, and the extras necessary for success.

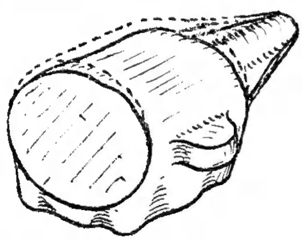


Fig. 22. Shrunken casting

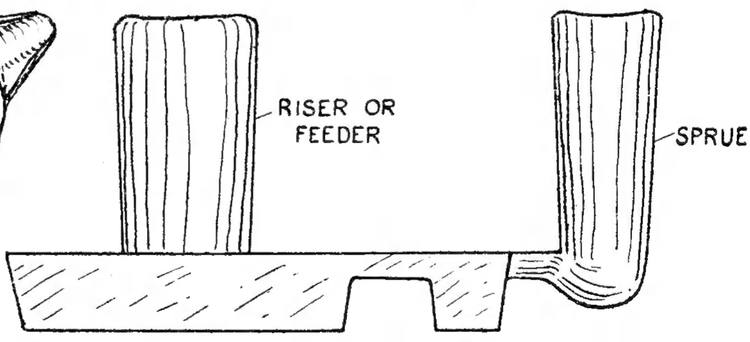


Fig. 23. Casting requiring a large riser

It can be stated that cores are broadly of two types—greensand and drysand.

The term greensand has nothing to do with the colour. The word green means raw or unprocessed as distinct from baked sand cores. Greensand cores are formed from ordinary damp moulding sand, at the time of moulding. A pattern such as an ashtray, is a typical example using a core of this type, Fig. 11. The sand is

sieved and rammed around the pattern and the mass of sand filling the hollow forms the core. When the mould is separated this "island" of sand is strong enough by virtue of its dampness and ramming to hold together. (See Fig. 16 which gives an impression in drag, showing green-sand core.) A safe rule to apply here is that the diameter or distance across the core is not to be less than the depth of metal through which it is to pass. Again, the amount of draft used on the inner sides

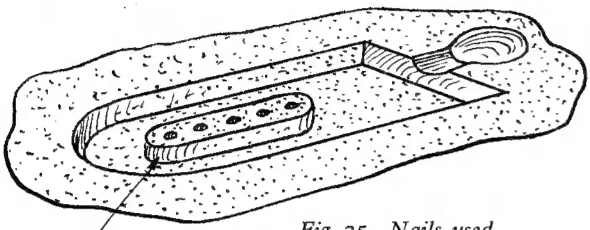


Fig. 25. Nails used to strengthen fragile core

of the pattern must be double that of the outside surfaces. A 1/32 in. per in. of depth is sufficient. More draft is required, because the sand tends to pack tightly and adhere more to the walls of the recess. Care must be taken in rapping the pattern, that the core is not disturbed or broken. These cores can often be reinforced with nails before pouring or removal of the pattern. Many moulds in industry are strengthened in this manner. The nails are pushed in by hand and finished flush with the top surface. Lath nails or round wire nails will be suitable, Fig. 25.

Draft

As the word draft will be cropping up frequently and there may be some who are not fully informed as to its meaning, I will digress a little to explain the term. A rectangular plate with perfectly square sides would be very difficult to cast if the sides were an inch or more in depth. On lifting the pattern from the sand after rapping, portions of sand would break away from the surrounding mould owing to the small amount of clearance present. Therefore, a taper of 1/64 in. per inch of depth is added to the width and length of the cope face of the pattern. This means that if for argument's sake the plate required was 4 in. long by 2 in. wide by 1 in. in depth the *cope face* of the pattern will be 4 1/32 in. in length by 2 1/32 in. in width. These measurements, by the way, being taken from a contraction rule for the particular metal being cast.

Contraction

As we all understand the fact that metals expand when heated and, therefore, contract on cooling from a molten state, allowance must be made in a pattern if the casting is to be up to size. As metals contract different amounts, a scale contraction rule is required for each metal. These rules are 12 in. or 24 in. long and are stamped with the name of the metal. They can be obtained from Messrs. J. W. & C. J. Phillips Ltd., 144, Pomeroy St., S.E.14 (in short supply at present).

The contraction allowance per ft. for cast-iron is 1/10 in.; bronze, $\frac{3}{16}$ in.; brass and aluminium, 5/32 in.

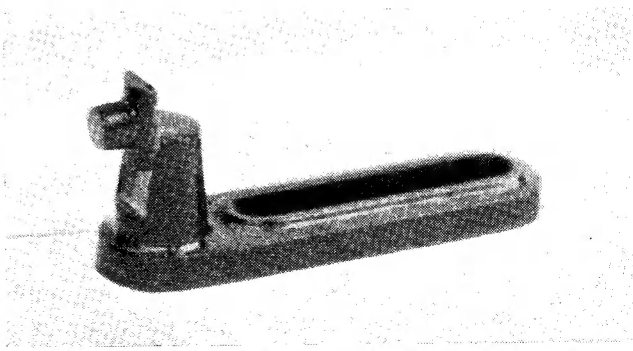
I strongly advise those intending serious work on this subject to buy a contraction rule marked for iron, steel and brass, No. 18, Rabone & Sons, as I find it covers most of the allowances needed and will do for aluminium as well.

The making of large patterns without a contraction rule is tedious and complicated if due allowance is to be made against the casting finishing undersize.

Machining Allowances

Where a surface requires machining either shaping or turning, an extra thickness of wood will be required at that part of the pattern. For cast-iron the amount should be $\frac{1}{8}$ in. but where the job is in brass, bronze, or aluminium a $\frac{1}{16}$ in. is usually enough. There is little scale on these latter metals and a surface will finish cleanly with this allowance. The surface on the pattern which indicates the machining is usually painted yellow all over or striped with yellow pattern varnish. This indicates to the moulder where the best metal is required and he will try to arrange that surface at the lowest point in the mould to receive the purest metal. Any dross present tends to float to the top of the casting.

Whilst on the subject of pattern making, an experience I recall is worth mentioning. Before the war, I attended an exhibition of model



A pattern using "loose-piece" to facilitate withdrawal from mould (Boys' work)

engineering where I saw a set of patterns for an engine of ambitious design. As I was examining these, the owner, seeing I was interested, spoke to me. He carefully explained the various details and I gathered that he had some considerable experience of these matters and I mentioned this fact, but to my amazement he said that it was his first engine. As I was somewhat inexperienced

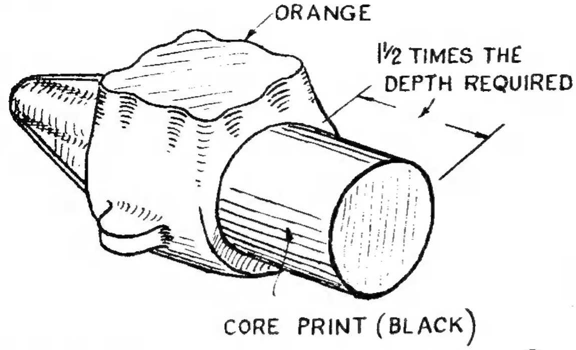


Fig. 26. *Pattern of i.c. engine crankcase, using core print*

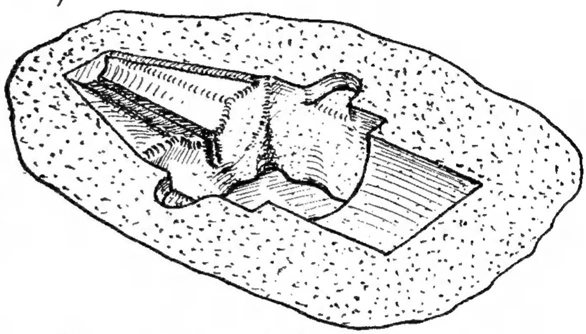


Fig. 27. *Impression in drag, showing core recess*

in model engineering at that time, but had done a little pattern making, I examined his patterns more closely. He had fallen into the common error of assuming that whatever shape was formed in wood could be drawn from the sand and cast. One or two of his patterns were so shaped that with projections on all sides, it was quite impossible to draw them from a mould without breaking the sand. Of course, these shapes may be cast, but will require a much greater knowledge of pattern-making practice to get over the difficulties. Awkward projections can be attached to "loose pieces" which are a sliding dovetailed fit and detach themselves as the pattern is drawn from the sand, see photograph. The projection is then removed from the sand separately. These patterns are very fascinating to make, but require precision in their construction. A book well worth obtaining on this subject is *Wood Pattern-making*, by Herbert J. McCaslin, published by the McGraw Hill Book Company, 13s.

Drysand Cores

When conditions are such that the drawing of the pattern will break down cores formed by the greensand method already described, cast holes and recesses will then require drysand cores. These are made in a wooden core-box by ramming core sand into the internal shape provided. They are then removed and baked in an oven. This might sound very simple and straightforward to perform, but really calls for great ingenuity and craftsmanship on the more complicated examples. A simple type of core can be used where the casting requires a blind hole to be cast into one of its faces. Provided that the centre-line of the cored hole lies on the parting line of the mould, no great difficulty will be experienced. To locate the core accurately in the required position, a core print or projection is made to stand out from the face of the pattern at this point. I will take the crank-case pattern as an example. The sketch shows the core print located on the rear face of the pattern, Fig. 26. You will remember that this was cast with the top bolting face downwards into the drag half of the moulding flask, the centre-line of the pattern level with the top of the drag. We can still use the same method and it will be seen that the core print makes a hollow in the mould dead in line with the crankcase recess. (See sketch, Fig. 27.) This core print depression will, of course, be reproduced exactly above it, in the cope. The core itself is made in the following manner.

(*To be continued*)

For the Bookshelf

The Model Railway Encyclopaedia, by E. F. Carter. (London: The Burke Publishing Co. Ltd.) 460 pages, size 5½ in. by 8½ in. Price 15s. net.

Any criticism of the title of this volume has been forestalled by the publishers, who claim that the book has been called an encyclopaedia because it is exhaustive and leaves nothing unsaid about a fine and fascinating hobby. The author has certainly made a praiseworthy attempt to collect together a very great deal of information on the subject and has included all relevant prototype practice. Consequently, there should now be no excuse for model railway builders and operators perpetrating errors which, hitherto, have often tended to spoil their efforts.

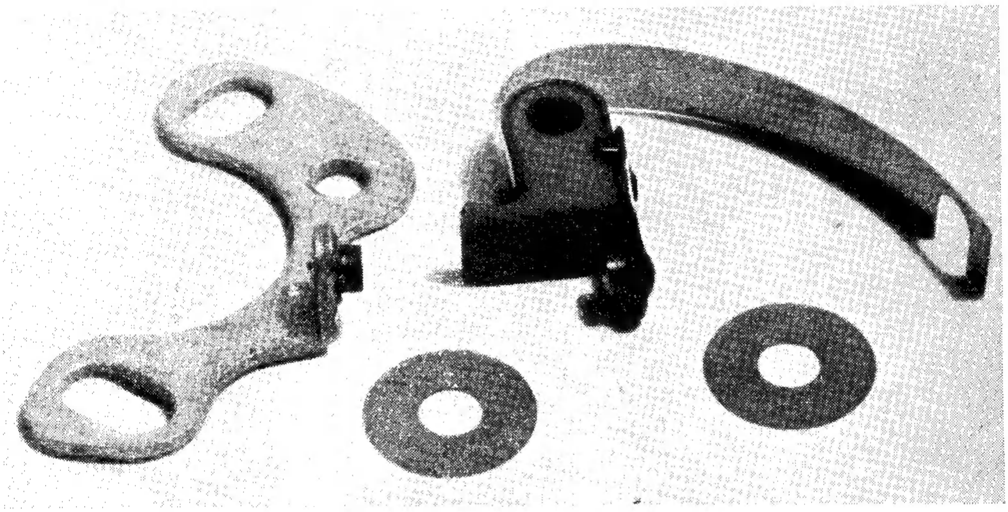
Unfortunately, the book itself is not entirely free from mistakes which might have been avoided by more careful preparation and editing. The author's style is apt to become somewhat involved and is not helped by faulty punctuation. Apart from this, the book is very conveniently arranged in upwards of twenty separate chapters, each devoted to a specific branch of the general subject. An appendix, a glossary, a bibliography and an index are included.

*The Elements of Maintenance

for 10-c.c. Racing Engines

by G. W. Arthur-Brand

NOW that we have treated the various parts of the engine proper, I have visions of large numbers of my readers frantically assembling their units, their thoughts firmly fixed on some devastating new b.h.p. curve. But believe me, chums, unless you intend to run glow-plugged, you won't get very far without paying careful attention to your contact-breaker assembly.



No. 1. A new set of car-type points

Let us start by dismantling completely, as shown in the illustration No. 1. Upon close inspection, do the points appear unduly worn? Has the spring lost some of its tension, or is it capable of doing its job at peak performance without introducing bounce? How about the bearing hole upon which the follower "jitters"; does that show any sign of wear? Should the answer to any of these questions be a definite "yes," it is time you bought a new pair of points, complete as illustrated. You will have to either drill or punch a hole in the spring and trim the end to the required length; these, however, may easily be done by comparison with the original and it is not anticipated that any difficulty will be encountered.

Having satisfied yourself that everything is now in first-class condition, we may proceed with the reassembly; but not without reflecting, briefly, upon what has gone before. You see, it occurs to me that some time during this period of operations, you might quite easily have felt a bit off colour some night, and in consequence may have rushed some part of the job which really deserves 100 per cent. accuracy and attention to detail. There is no crime involved; we are all susceptible. Should this prove to be the case, go once more over the parts which might have been affected, and the chances are a hundred-to-one that you will find just that little bit of fault which will make all the difference.

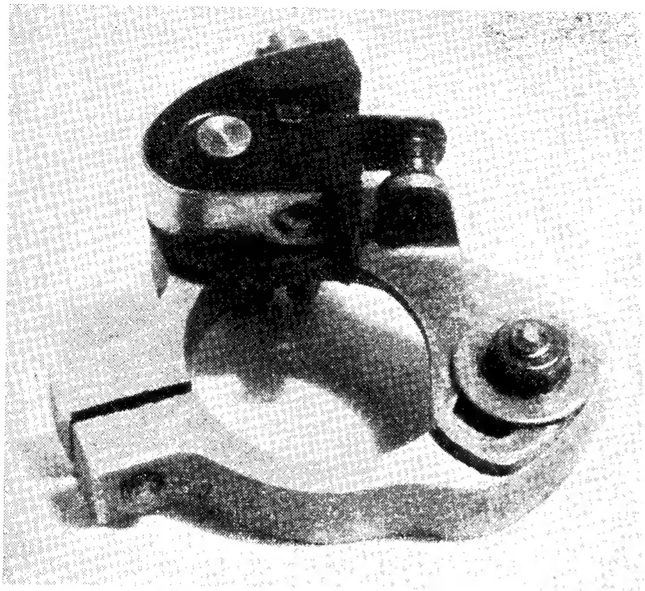
Now let us proceed.

Assuming that you followed my instructions carefully, there should be little chance of foreign bodies having re-entered the ball-races, but just for luck we are going to give everything another bath in clean petrol!

Your container should be a fair size, so that any sludge will sink to the bottom, allowing use to be made of a fairly clean portion of fluid somewhere up near the top. Oh, and by the way, you will require a tooth brush to get everything out of the transfer passage and from between the finning. Sorry I didn't mention this before, but the chances are you will have an old one knocking about somewhere. If not, use the one in the bathroom and treat your dentures to a new tuft of bristle on the morrow.

First give the main casting a good soak, then brush vigorously to dislodge all remaining particles of aluminium, and wash again. Dry with clean rag, this particular adjective applies throughout, and lay aside to await insertion of

*Continued from page 774, "M.E.," June 1, 1950.



No. 2. Contact-breaker assembly

the cylinder liner, which should also be given a bath. When carrying out this operation (the insertion), it is imperative that you make absolutely certain (a) that your porting is right way round, and (b) that the transfer ports in the liner are kept in perfect alignment with the transfer passage.

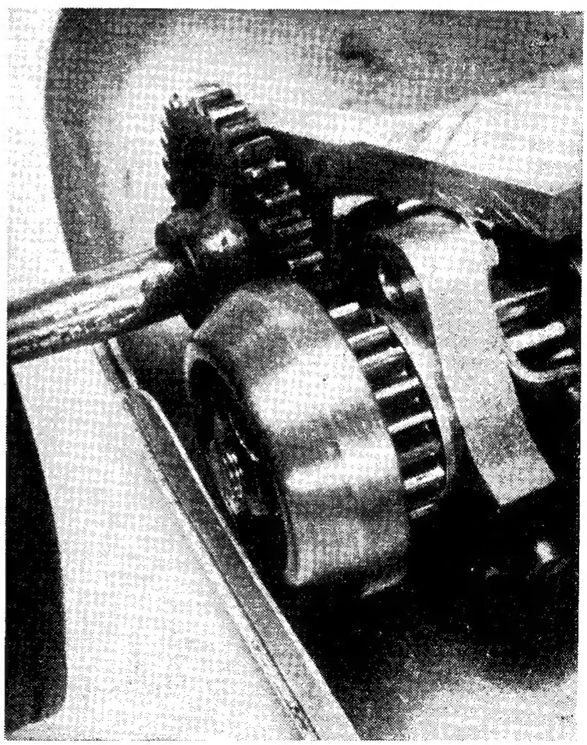
I can hear some of you saying " Ha-ha, he has gone and inserted the liner and he hasn't got his piston fitted yet." And I am going to reply that it was just a little trick of mine to stop you using that very handy chamfer in the bottom of the liner as a means of forcing the rings into their grooves. I have seen both pistons and rings ruined by this practice and even then I doubt whether a lady was ever present when the bottom ring had completed, or rather been *forced* to complete, its entry !

You will soon discover how delightfully easy the whole procedure can be, but first of all, a bath for the piston, connecting-rod and gudgeon-pin. A bath for the tooth brush, too ; then a really good run round the ring grooves and a thorough drying for the trio, after which assemble the little-end accompanied by the application of a modest drop of that light machine oil I mentioned before. Place a couple of drops in the grooves and carefully spring the rings into place, bottom ring first *over* the top groove, then rotate clock and anti-clockwise to work the oil well round the walls. Be careful not to scratch the piston during these manoeuvres.

Ready to carry out the insertion routine ? O.K., let's go !

Allow the piston skirt to enter the top of the cylinder liner—stand back and watch ; no ? Oh dear, you will have to offer some assistance ! So sorry. Anyway, when the bottom ring is resting on the rim of the liner, place one finger-nail on the periphery opposite the gap and with the thumb and forefinger nails of the opposite hand, work gradually round to the gap in a pinching motion, the while placing gentle pressure on the crown with the remaining free thumb. It might not work first time, but with a bit of practice there will be absolutely nothing in it. Before entering the top ring, see that the gap is opposite that of the bottom one, or you will most certainly lose compression.

Your next job will be the fitting of the crankshaft to the front crankcase cover and bearings. Wash out any old oil with clean petrol so that the races are free to revolve when flicked with the index finger. Rinse and dry the crankshaft, enter and carefully press three parts of the way home, then with your oil-can



No. 3. Transmission of the " M.C.N." Grand Prix Special

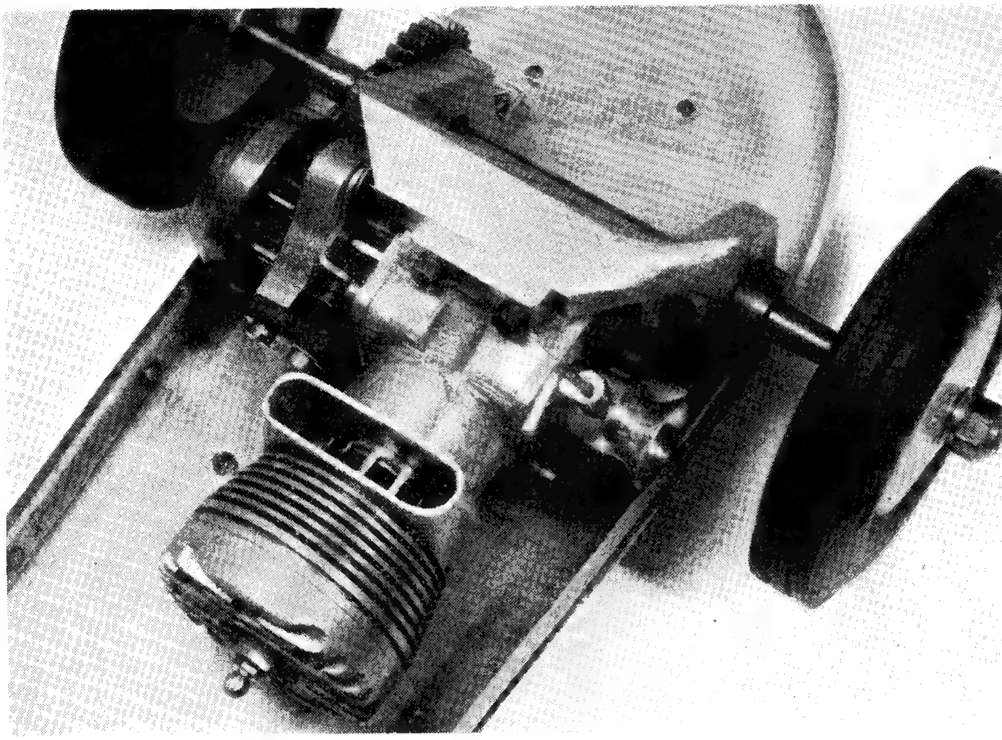
apply a drop or two of oil before pressing home. The journals should be a good push fit without necessitating any mechanical persuasion, which might tend to damage the races. This front assembly must now be fitted to the crankcase.

A number of varying points of view exist as to the most suitable means of sealing crankcase joints and many enthusiasts insist on using a shellac-based compound. I, personally, have never used anything but good quality white vaseline and I am confident that this will, in the majority of cases, give excellent results. There is, of course, a provision, and that is that the contact faces must be absolutely true and unscratched, which they should be if reasonable care has been taken as suggested in previous issues. A light, even smear is all that will be required and the screws should be inserted from diametrically opposite corners and driven home ■ little at a time, ensuring even distribution over the entire surface. All screws, incidentally, should be given a further run over when your engine has been run for a while and allowed to warm up. Oh, and don't forget a spot of oil on the big-end ; also, make sure that your piston is right way round !

Next fit the rear crankcase cover assembly, being careful not to damage the carrier recess in the rotary-valve disc as you insert the crankpin. Make sure that a correct entry has been made by gently revolving the crankshaft in both directions, then immediately insert screws as above.

The fitting of the cylinder-head is quite ■ straightforward procedure and should involve no difficulty. Here again, see that it is right way round and remember the smear of vaseline, and the equal distribution of pressure when tightening down.

Finally, fit the contact-breaker assembly and align so that both faces of the points meet squarely. This may require the use of a pair of long-nose pliers and ■ certain amount of discretion will have to be exercised if damage is to be avoided.



No. 4. Horizontal installation. The " M.C.N." G.P. Special

A word of warning ; don't rush to your work-bench and endeavour to start the motor without first running-in for a period of from one to two hours on the lathe, or driven, minus the plug, by ■ suitable electric motor. A generous supply of oil should be fed to all moving parts and the addition of ■ drop or two of " Redex " will usually be found to produce good results.

Initial running-in should be done on a straight fuel such as 75 per cent. best quality methanol and 25 per cent. refined castor oil. Only after several hours running should " hot " fuels be used.

I think I have covered as much ground as space will permit in a series of this type, but just before I close, one final word ; do keep ■ record of settings, performance and the various alterations you make from time to time. And remember, only one alteration at a time, *please* !

REBORING A LATHE HEADSTOCK

by N. C. Munro

IN a recent copy of THE MODEL ENGINEER under "Queries and Replies" the writer noted an enquiry referring to the possibility of reboring the headstock bearings of a small lathe, and my experience in this matter might be of interest to other readers.

I purchased a 3 in. lathe of the cheaper variety just prior to the war and although it was a fairly well made and robust job, the headstock bearings were of cast-iron and integral with the bed so that no adjustment was possible to correct any inaccuracies in manufacture.

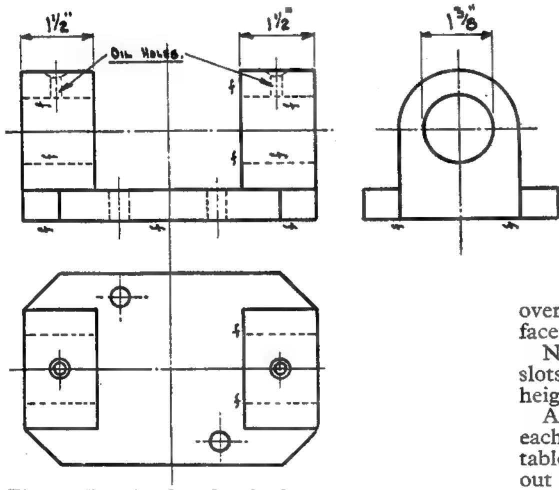


Fig. 1. Bearing bracket for boring bar. Material, cast-iron

When working between centres and using the self-act or turning work in the chuck or on the faceplate and using the compound slide rest, it was an easy matter to correct errors in parallel turning. The trouble arose when using the self-act on work in the chuck, in other words, the headstock bearings were out of alignment with the bed to the extent of a difference of 0.01 in. in 5 in. when trying to turn parallel.

This state of affairs needed attention, and as I had no means of sub-letting the job to a properly equipped workshop I decided to risk it and have a "go" myself.

The first thing necessary was some means of holding a boring bar on the table of the slide rest, knowing that if the bearings were bored in this manner they would at least be in alignment with the bed.

Secondly, having satisfactorily settled the means of boring, a method of revolving the cutter was required, and not having any means of driving it by power I decided to enlist the help of a car ratchet spanner and laboriously turn it by hand.

The following brief description of the bits and pieces made and used will elucidate the foregoing, and it is sufficient to say that when the job was completed the error was reduced to 0.001 in. in 5 in., which, to my mind, made the effort worthwhile.

Fig. 1 shows a cast-iron plate carrying two solid bearings, the pattern for which was quickly made and a casting purchased.

The first step was to approach a friend, a shaper by trade, who quickly ran a cut over the underside of the base and the inside face of one bearing.

Next the base was drilled to match the "T" slots on the table of the slide rest and the centre height marked on the outside face of the bearings.

A hole 1 in. in diameter was drilled through each bearing and the casting replaced on the table, rigidly bolted down, and the holes bored out to $1\frac{3}{8}$ in. diameter by means of a boring bar mounted through the casting and between centres.

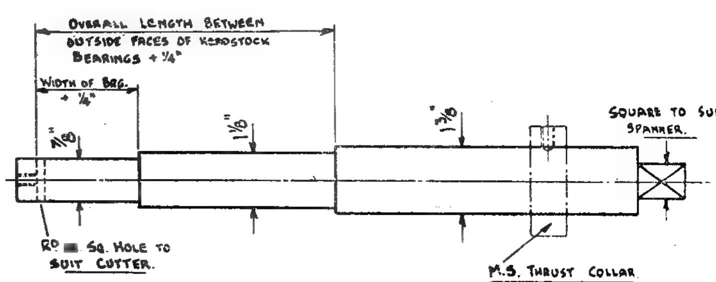
This completed stage one and attention was given to the boring bar to be used for the job proper.

A piece of $1\frac{1}{2}$ in. diameter black mild-steel was centred and turned as shown in Fig. 2 and a square filed on the end to suit the ratchet spanner.

The bar was drilled to take a tool-bit and a locking-screw provided, as shown in Fig. 2.

The lathe spindle was now removed, packing-pieces inserted in the split on the adjustable side of the bearings, the adjusting bolts tightened

Fig. 2. The boring bar. Material, mild-steel



up and the boring attachment mounted in place on the slide rest.

From this stage plenty of patience was needed, as, owing to the distance between the cutter and bearing, only very light cuts were possible, to avoid chatter.

In my own case I manipulated the ratchet spanner whilst a second person slowly applied the feed by means of the leadscrew.

These were made a good push fit in the headstock, and drilled and channelled for lubrication.

The packing strips were removed and the pinch-bolts tightened up sufficient to restrain the bearings.

After running the lathe thus fitted for several months a minute amount of wear was detected in the bearings, which I then sawed through on one side enabling me to make any future

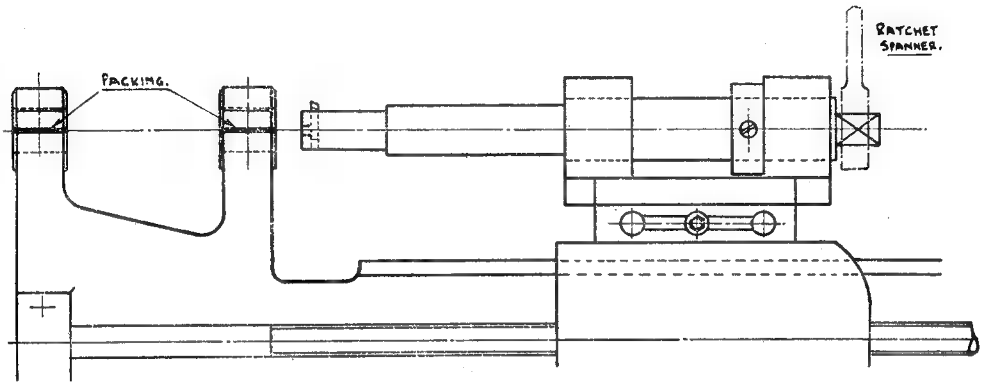


Fig. 3. Attachment set-up ready for boring

adjustments by clamping up, as previously done on this lathe.

The actual boring took several hours owing to the slow and intermittent rate of turning of the cutter, and whilst the bore diameter was such as to allow approximately 5/32 in. wall thickness in the brasses to be fitted, no effort was made to work to any exact dimensions.

The bushes were turned up from phosphor-bronze on a friend's lathe, the front one with a shoulder on for taking spindle thrust and the rear one plain.

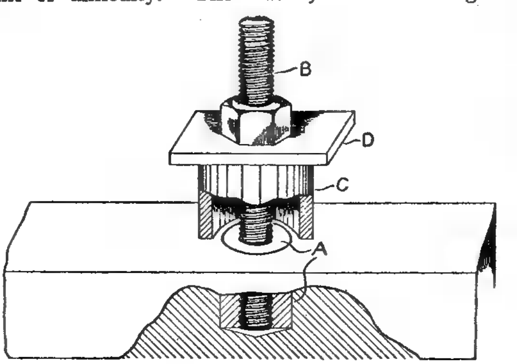
The whole job, allowing for odds and ends collected from a scrap-heap, cost about 15s., and I now have not only a much more accurate lathe but one with renewable bearings.

Fig. 3 shows the set-up ready for boring and detailed dimensions are not stated as these will, of course, depend on the particular lathe to be corrected.

Removing a Small Bush

THE removal of a small bush which needs renewing from a piece of work sometimes presents a certain amount of difficulty. The problem is more acute in cases where a blind bush requires removing, since it is impossible to try the method of knocking it out. A very good method of removing small bushes is indicated in the following manner.

The bush to be removed is indicated at *A*, in the accompanying illustration, and the first step is to thread it as deep as possible with the nearest size tap. Obtain a bolt or length of screwed rod to fit the thread, which is indicated at *B*, and with it a good fitting nut. A piece of tubing *C*, a little longer than the length of bush is required, also a plate *D*, which is drilled to fit over the screwed rod. The bush may now be removed by fitting up as indicated in the illustration, and screwing on the nut with a spanner. This leaves undamaged the hole in the work, into which a new bush may be fitted.



—W. J. SAUNDERS.

* Miniature Slide and Strip Projectors

by "Kinemette"

THE dissertation on basic theories of optics, which has occupied the last two articles in this series, may have been regarded as a digression from the main theme of constructing the projector, but as a matter of fact, the little that remains to be done on this particular model is quite simple and obvious. It consists of fitting the transformer in the base casting, wiring up the lamp and switch, and final assembly of the various components after they have been enamelled or otherwise treated to suit the taste or fancy of the constructor.

A suitable transformer for the projector is available from the source mentioned in the May 25th issue, or it may be made and wound according to the instructions in THE MODEL ENGINEER handbook *Small A.C. Transformers.* It is not too easy to obtain materials for electrical work these days, as many of the firms which catered for the constructor in the past seem either to have gone out of business or have turned to the easier and more lucrative business of selling ready-made electrical products. There are, however, any amount of second-hand transformers now available on the surplus market at prices sufficiently low to make it worth while to rewind them for the required output. It is only necessary to obtain a carcass or pack of laminations having the required cross-section and winding space to suit the output, as specified in the above handbook, and wind the primary and secondary coils to the instructions given. The rating should be on the liberal side, so that risk of the transformer being overloaded and heating up is avoided; the specified 15 V should be obtainable under full current load of not less than 4 A for continuous working.

The transformer may be fitted inside the base by any convenient method; in the case of the one specially designed for the "M.E." cine-projector, four feet are provided on the frame to take fixing screws. These enable the transformer to be fitted in an inverted position, by screws passings upwards through the top of the base casting, though the drilling and tapping of holes in this position may be found somewhat awkward owing to the depth of the recess. An alternative and easier method of fitting is to bolt the transformer to a floor-plate of about 16-gauge sheet metal, which is then fixed to the underside of the base by about half-a-dozen $\frac{1}{8}$ in. or 4-B.A. screws, forming an undershield to enclose and protect the electrical components. The plate should have several holes drilled in it of ample size to allow free flow of ventilating air.

It is desirable to fit a switch to control the projector lamp and the best place for this is on the back panel of the base casting. In keeping the dimensions of the latter as compact as possible, however, not much room has been left for fitting the usual type of panel-mounted tumbler switch, as this projects inwards at the back of the panel and is liable to foul the transformer. There are, however, many types of small switches available; it would be possible to select one which fits entirely outside the panel surface, though any very large or obtrusive excresence on the panel is liable to look rather untidy. A small Bulgin toggle switch has been fitted to the projector illustrated and has proved quite satisfactory. An alternative arrangement is to fit a switch in the supply lead, and suitable switches are readily available, but this position is not so handy in cases where it becomes necessary to grope for the switch in the dark.

Wiring calls for no special comment, except that it should be neatly carried out; the transformer connections should be soldered and the leads sleeved with rubber or other suitable material where they pass through the walls of the base. The supply leads may conveniently be taken through the back panel, below the switch position, and the lamp leads through the top, near the front of the lamphouse.

The switch may be fitted either in the supply lead or the lamp circuit, the former position being preferable on general principles. It is often thought that when using a very small switch, it would work better on low-tension current than on the mains, but this often proves a fallacy, as the limiting factor in such switches is usually the small area of the contacts, which are liable to heat up if they carry a heavy current. When used on the mains, the insulation stress is comparatively heavy, but the current carried is much lighter than in the low-tension circuit; if the switch is initially sound in construction and method of insulation, it is not likely to give trouble under working conditions.

Enamelling

The castings of the projector may be given a neat and durable finish by enamelling, and any good grade of air-drying or stoving enamel, either oil-base or cellulose, will be found satisfactory. It must be capable of standing a certain amount of heat, but under normal working conditions the temperature rise of the hottest part of the projector—the top of the lamphouse—is not sufficient to call for the use of special heat resisting enamel. The interior surfaces of the lamphouse, condenser housing, etc., should have a dead-black, non-reflecting surface, and a good paint for this purpose may be made by mixing equal parts of vegetable black and domestic black lead (plumbago) in powder form, then working them down to a smooth paste with Japan gold size, either with a pestle and mortar, or on a *clean* stone slab, using a palette-knife.

**Continued from page 757, "M.E.," May 25, 1950.*

This paste is then thinned down to working consistency with turps ; it is suitable not only for dead-blacking either metal or wood optical fittings, but also as an undercoating or filler for " building up " surfaces, using as many successive coats as may be necessary, and rubbing down between coats until the required surface and " body " are obtained.

Many constructors will like to obtain the crystalline or " crackle " finish which is so popular nowadays, and there are several preparations available for obtaining this finish, but some of them are not so easy to use as they might appear, and special stoving or other treatment is called for in one or two cases. The best advice which can be given in the circumstances is, whatever preparation is used, follow the maker's instructions to the letter—and if the desired results are not obtained, complain to them ! This class of enamelling is, however, undertaken by several professional firms at reasonable cost, if the constructor does not wish to tackle it himself.

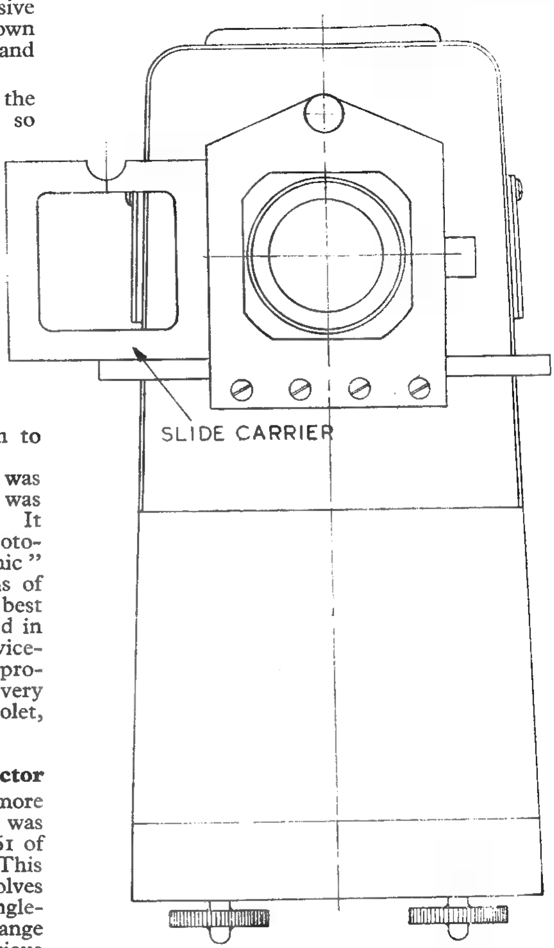
The projector which has been illustrated was not given any " fancy " treatment, as it was required in a hurry for experimental work. It was initially finished in grey enamel for photographing, as this is the most " photogenic " shade (readers who wish to get photographs of their models which will show them off to best effect, please note !) and later on was finished in a semi-matt " eggshell " black, which is serviceable and reasonably neat. After all, the projector is no show piece, and its work is done very unobtrusively indeed ; like the modest violet, it is " born to blush unseen ! "

The "Universal" Slide and Strip Projector

At the request of very many readers, a more detailed description of the projector which was briefly referred to and illustrated on page 261 of the March 2nd issue is given herewith. This instrument is larger in overall size and involves more work in its construction than the single-frame strip projector, but it has a wider range of application and can be adapted to use various and more powerful forms of illuminants. Many users of 35 mm. miniature cameras have expressed interest in this type of projector, which is suitable for use with transparencies which can be made, either in slide or strip form, by contact printing from the 35 mm. negatives.

The general arrangement of this projector shows that it resembles the previous type in general design but differs mainly in the dimensions of the lamphouse and the details of the stage fittings. In place of the hinged " gate," which follows cinematograph practice to some extent, the stage is more in conformity with older " magic lantern " practice, being adapted to take detachable fittings for either slides or filmstrips, and a further difference is that the entire stage and optical system can be rotated through 90 deg. to suit either horizontally or vertically-disposed filmstrip frames.

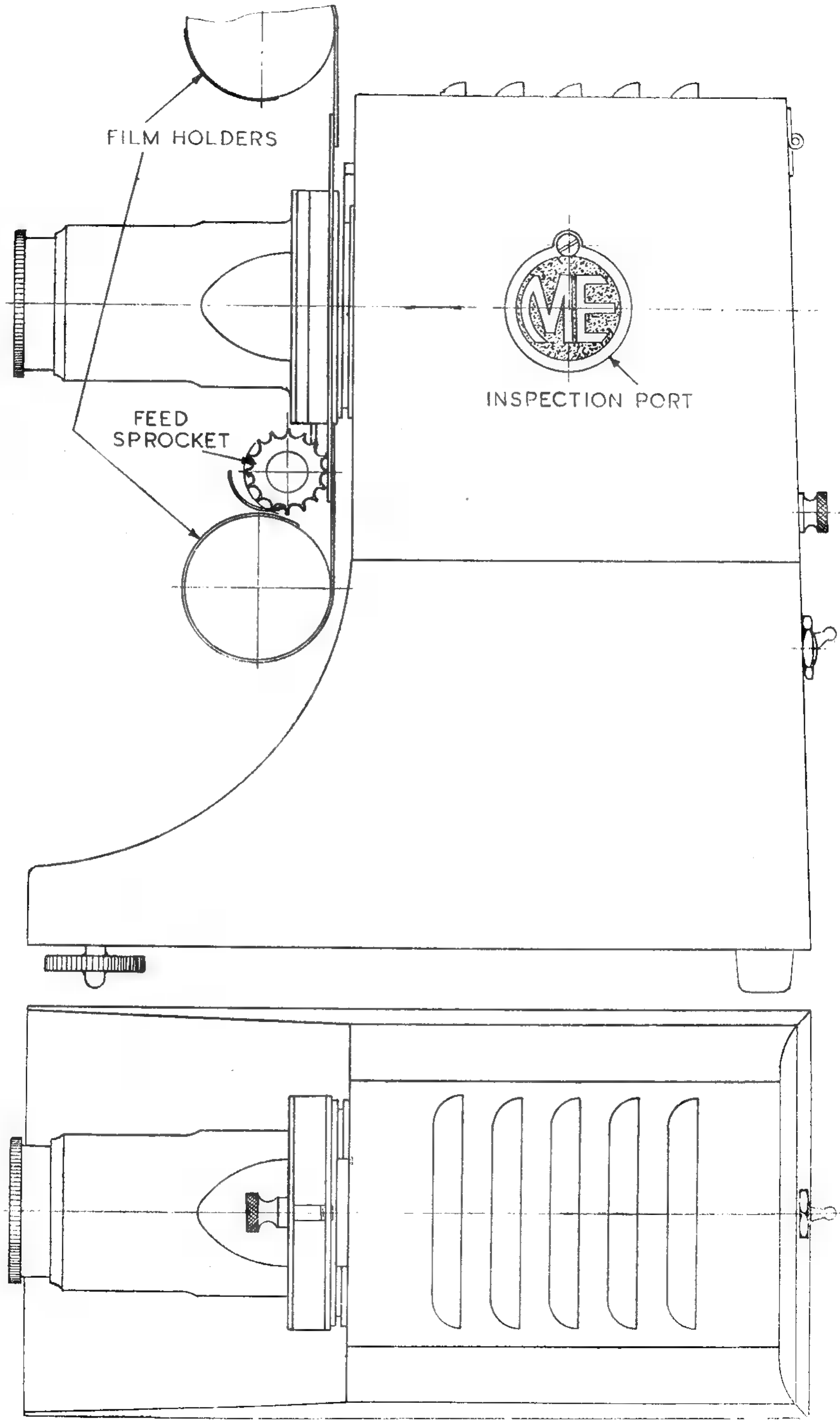
In the side view of the projector, the filmstrip holder is shown in position, and it is arranged at the angle suitable for showing single-frame filmstrips with the usual horizontal frames, or double-frame filmstrips with vertical frames. The front view shows the slide holder in position



Front view, showing slide holder in position

the stage being rotated through 90 deg. to bring the holder horizontal. As the standard glass slides are square, either vertical or horizontal pictures can be shown without shifting the stage.

No castings have been used in the construction of this projector, though they may be employed if desired, just as in the previous type, and in certain cases, this would simplify the constructional processes. The lamphouse and base, however, being larger than those of the other projector, would be comparatively expensive, and sheet metal is certainly the cheaper method of construction for these parts, besides being an interesting exercise in metal bending, forming and fabrication. Sheet aluminium is a suitable material and has the advantage of being very easily shaped, but other materials such as sheet-iron, brass or copper may also be used if preferred or more readily available. The particular

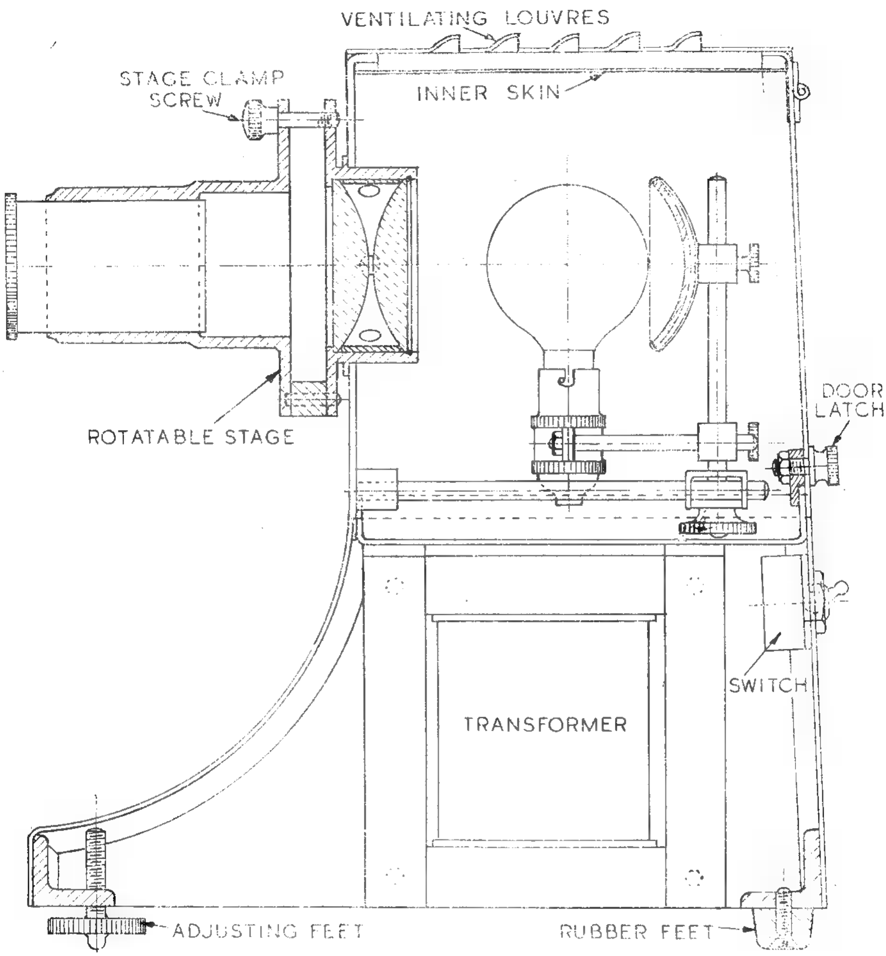


Elevation and plan of "Universal" miniature projector, showing filmstrip holder in position

methods of fabrication adopted favour the use of the more ductile metals, but in this respect also, modifications to suit the particular medium are permissible.

If desired, this projector can be fitted with exactly the same transformer, lamp and fittings as those recommended for the other, and will produce the same standard of performance, except that when using single-frame filmstrips, to employ it to full advantage, objectives of different focal lengths should be used for the two sizes of frames.

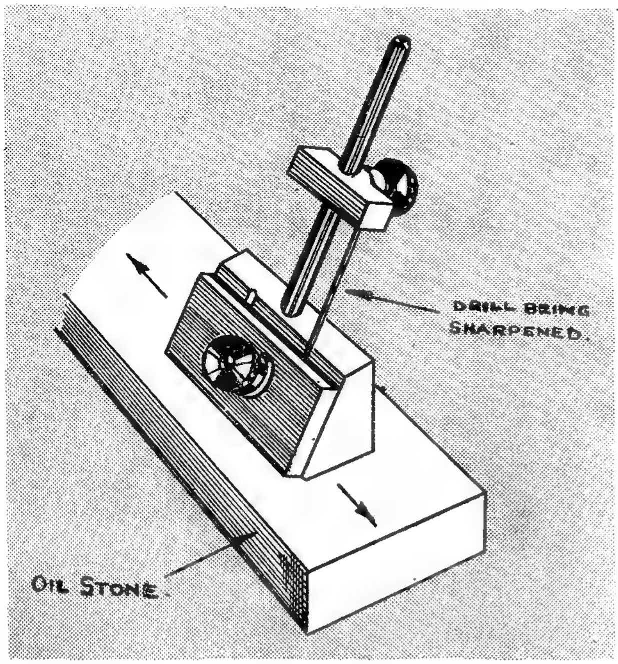
If, however, more powerful illumination is desired, it is possible to fit a larger transformer in the base, to supply a lamp of twice the wattage, or more. There are several types of low- or medium-voltage projection lamps available and any of these can be used, provided that the



Section through base and lamphouse

only a part of the light collected by the condenser can be utilised and therefore full illuminating efficiency is not obtained. This could be remedied by arranging for the temporary insertion of a spacing bush between the condenser and the stage, so that the narrowing of the cone of rays would enable more of the available light to be focused on the smaller frame. But such a fitting would complicate the change-over from one size of frame to the other, and also necessitate complete readjustment of the illuminating system; appropriate form of lampholder is fitted, and the transformer is wound to suit the voltage of the particular lamp, or provided with tappings to give different output voltages. Alternatively, projection lamps for direct mains supply up to 250 W can be accommodated in the lamp-house, though the dimensions of the latter are not so large as is really desirable for these lamps. It may be questioned, why not make the lamp-house larger ?—but compactness is a feature

(*Continued on page* 828)



A Jig for Honing Small Twist Drills

by

R.H.C.

TWO correspondents have described recently an almost identical tool for sharpening small drills, which no doubt gives the desired results ; nevertheless, I think that the little jig as constructed by me has some added advantages, whilst being equally simple to construct.

I notice that in the case of the jigs constructed by both Messrs. Kendall and Allison, the drill is presented to the stone at an angle of 45 deg., which produces a drill with a 90 deg. point. In my case I use an angle of 59 deg. which provides a drill point of the more usual angle of 118 deg., which I consider is more suitable for general work, although I agree that drills sharpened to the more acute angle may give better results for certain applications.

I agree with Mr. Allison that although drills sharpened with this type of tool have flat faces, *so do the points of centre drills* ; they seem to cut quite freely.

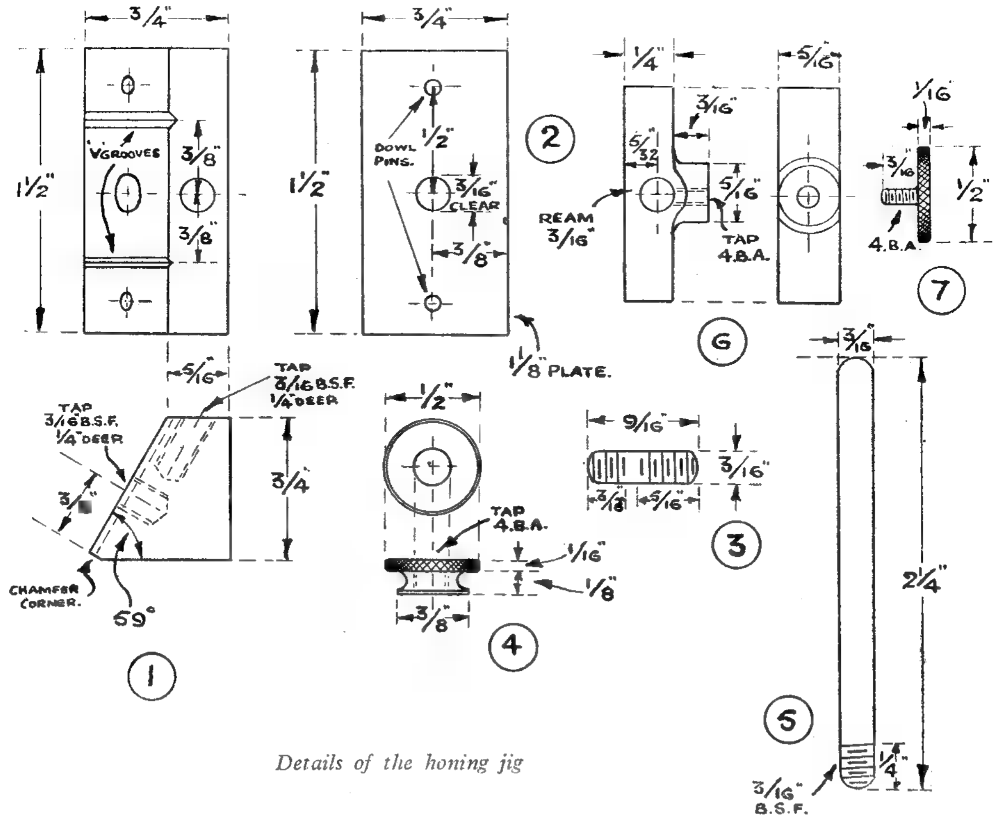
The other main difference in my tool is the provision of a length-stop which is set before commencing grinding ; after the first face has been ground, it is then only necessary to slacken the knurled clamping-screw, and turn the drill round to bring the other face into contact with the stone and continue grinding ; a little practice should produce a uniform point.

The base (1) is made from a short length of $\frac{3}{4}$ in. square B.M.S. This is held in the four-jaw chuck and the ends faced to give an overall length of $1\frac{1}{2}$ in. ; a line is then scribed on one end at 59 deg. to the base line, after which it is rechucked in the four-jaw and the scribed line set at 90 deg. to the lathe bed by means of the square. It is then faced down to the scribed line. Whilst still in the chuck the hole for the $\frac{3}{16}$-in. stud for the drill clamping plate (2) should be drilled and tapped. The clamping plate (2) may now be cut from $\frac{1}{8}$-in. × $\frac{3}{4}$-in. plate and drilled $\frac{3}{16}$ in., after which it is clamped to the base by means of a temporary $\frac{3}{16}$-in. screw passed through it.

Now mark out and drill the two holes for the dowel pins, using a size of drill suitable for a "push" fit for the size of pins you intend to use, and drill right through into the base for a depth of $\frac{3}{16}$ in. The holes in the base may then be opened out with the next larger size number drill. Cut two suitable lengths of silver-steel wire, and press into the clamping-plate and file off flush on the top side. To facilitate drilling the tapping hole to take the rod (5) which carries the length-stop (6), and to stop the drill running off, make a little drilling jig out of a piece of scrap and clamp in position for drilling. Mark out the position of the "V" grooves, and set up the base on an angle-plate or vertical-slide and mill the grooves with a countersink.

The length-stop (6) is made from a short piece of $\frac{5}{16}$-in. plate which is mounted in the four-jaw and faced down to form the boss for the clamping-screw. Before removing from the chuck it is drilled and tapped 4 B.A. to take the clamping-screw (7). All that remains is to cross drill and ream $\frac{3}{16}$ in. in order that it may be a nice fit on the rod (5).

The clamping-screws (4) and (7) are simple turning jobs. If a knurling tool is not available, a number of small grooves may be cut around the edges by means of a "V"-pointed tool mounted on its side in the toolpost and traversed by rocking the saddle. Before assembling, drop a little brass pad into the 4 B.A. tapped



Details of the honing jig

hole in the length-stop to avoid the clamping-screw damaging the rod.

This little tool will well repay the time spent in its construction, as provided drills are not allowed to get into too bad a condition, they may be resharpened in a very few minutes.

Miniature Slide and Strip Projectors

(*Continued from page* 826)

which must be studied, to some extent at least, in any instrument which has pretensions to being a "miniature" projector, unless its whole aim and object of existence is to be defeated. The individual constructor can, if he so desires, open up the dimensions of this or any other part of the projector to suit his own convenience.

Cooling, of the lamphouse, when powerful illuminants are employed, is a most important consideration, and the same method of ventilation by convection currents is used as in the other projector, the size of the apertures being greatly increased to improve airflow, and louvres being provided in the roof of the lamphouse for free escape of hot air. A further refinement in the cooling consists of a "double skin" in the lamphouse casing, enabling air to flow freely around the inner compartment and reducing the amount of heat transmitted to the exterior casing.

Although provision for inspection of the lamp is not a necessity where electric filament lamps are used, it is sometimes useful, and windows with pivoted "escutcheons" are fitted in each side of the lamphouse. Coloured glass, preferably blue or dark green, should be fitted in these windows, and as an alternative to using them as inspection ports, it is possible to provide one or both with an adjustable mirror or prism to act as a pilot lamp, to assist film threading or reading of notes.

The original projector of this type is fitted with a single adjustable foot in the centre of the base front, but although this gives fairly satisfactory results for adjusting the angle of inclination, it does not provide such good rigidity as the two adjustable feet of the other lantern, so the drawings have been altered to conform with the latter feature.

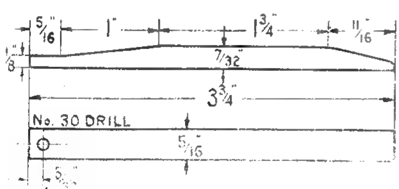
(*To be continued*)

"PAMELA" by "L.B.S.C."

A $3\frac{1}{2}$-in. Gauge Rebuild of a Southern Pacific

SEVERAL followers of these notes who are busy on the little *ex*-spam-can, are asking if it would be possible to "go the whole hog" and fit unit-construction Baker valve-gear, same as my *Tugboat Annie*. If so, what about the drawings for same? Why, certainly! I believe I mentioned something about this previously; in fact, I would personally prefer the Baker gear, so all being well, and our friend the K.B.P. having no objection, I'll try to squeeze time to do the needful. Meantime, there is plenty to go on with. The guide-bars are much the same as those specified for *Doris*, but are a little longer, viz. $3\frac{3}{4}$ in. They can be made from $\frac{1}{4}$ in. $\times$ $\frac{5}{16}$ in. steel rod—either silver-steel or mild-steel will do—and as they constitute a plain milling or filing job, and all dimensions are given in the accompanying illustrations, there is no need to waste time and space by a needless dissertation. Just make certain that the rubbing faces are as smooth as you can possibly get them. I use a linisher for jobs like that.

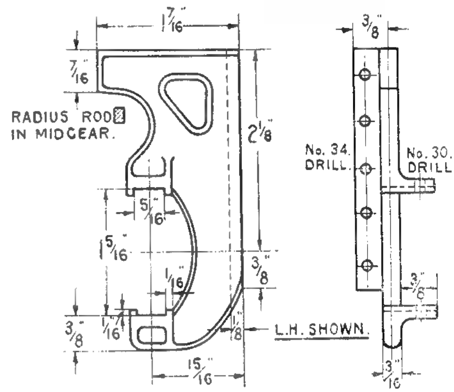
Same applies to the yokes, or brackets, which support the outer ends of the bars. Our approved advertisers are supplying castings for these; and the samples I have received, merely need cleaning up on the flanges, and the grooves or channels for the bars cleaning out. The former job can be done by any beginner, by rubbing the contact face on a medium-cut flat file on the bench. I know quite well, that the "correct" way is to put the casting in the bench vice, select a suitable file, hold it in the approved "regulation" manner, take your stance at the vice with the left foot forward (or the right one, if you happen to be "cackhanded," as the kiddies call it) and take steady strokes, pressing the file downward, keeping it level, and so on and so



Guide-bar

forth. However, I've found, often enough, that the "correct" way is neither the quickest nor the most accurate; life is short, and it doesn't matter what route you take, so long as you get there!

The way I should machine out the channels or jaws, would be to clamp the casting by its trued-up flange, to a bit of square bar, using a toolmaker's cramp at each end; grip the bar in the machine-vice on the table of my vertical milling machine, the bar being set level, and the jaws of the casting pointing upwards. I have a little milling cutter $1\frac{1}{4}$ in. diameter and $\frac{5}{16}$ in. wide, for which I made a stub spindle, to fit the miller; so all I would have to do, would be to raise the table until the channels in the jaws were level with the cutter. A few turns of the cross-slide handle, would traverse the casting past the cutter, which would pass between the jaws, and clean out one channel. Then $\frac{1}{16}$ in. end movement



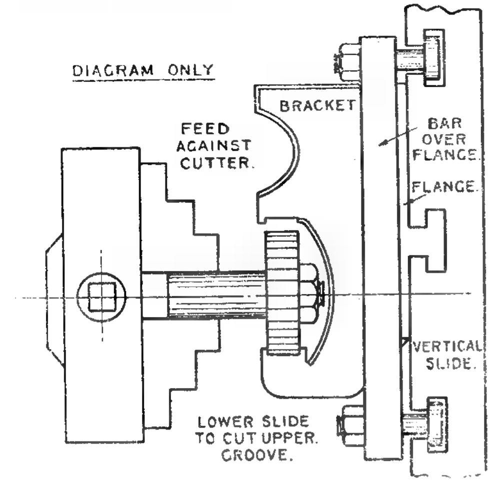
Guide-bar bracket

of the table, would set the casting O.K. for cleaning out the second channel; and turning the cross-slide handle in the opposite direction, would pull the casting past the cutter again, cleaning out the channel and finishing the job in less time than I can write this.

Anybody who has a vertical slide for his lathe, can duplicate the process easily, by putting the cutter spindle in the three-jaw, and attaching the casting to the vertical slide; a bit of bar across the flange, with a bolt at each end engaging in the tee-slots in the slide, will hold the casting rigid. The diagram shows the whole set-up better than any explanation. A narrower, or smaller-diameter cutter can be used, simply taking two "bites" to get the required width of channel; a Woodruff key cutter is just the boy for the job, and these can be obtained in a variety of sizes. The cutter is simply a little milling cutter in one piece with a spindle. I still have two or three bought "surplus" for a few pence each, after the Kaiser's war.

The bars are attached to top and bottom of the gland bosses on the back cylinder covers, by a $\frac{1}{8}$-in. or 5-B.A. screw, put through the No. 30 hole in the bar, into a tapped hole in the boss; make certain both bars are central, and have them hard up against the cylinder cover. When the whole issue is erected, the outer ends of each bar

will be supported by a similar screw, running through the No. 30 hole in the projecting bit of channel (see illustration) into a tapped hole in the bar, any projection of the screw through the rubbing face being filed off smooth.

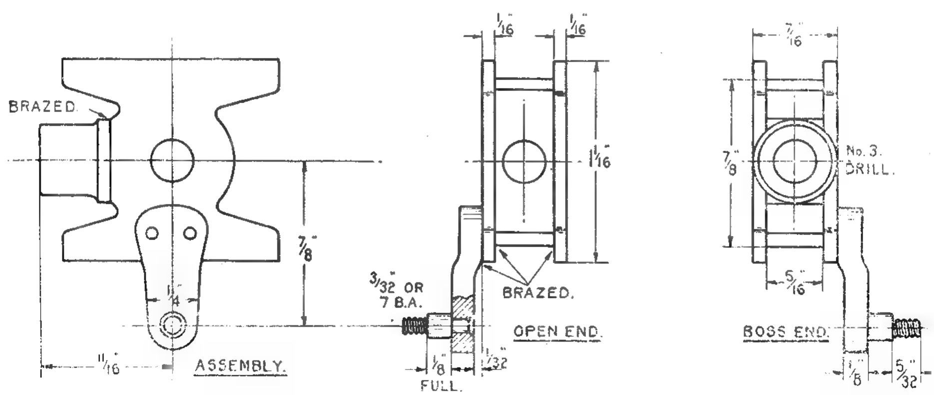


Easy way of machining grooves in guide-bar bracket

Crossheads

The crossheads themselves are similar to those specified for *Doris*—we are supposed to be re-building a spam-can with what stuff we can find in the stores, so as to avoid adding to that twenty million pounds that British Railways are reputed to have lost !—the only difference being that the drop-arm hasn't so much offset, and a crankpin is added, to take a plain union link instead of a fork-ended one. Two, at least, of our advertisers are supplying nickel-bronze castings for this type of crosshead, and the use of them saves a lot of work ; however, they are easily built up. The methods advocated by another writer in the issue of April 27th last, are O.K. for American locomotives with crossheads of " Bill Massive " proportions, but not applicable to the job in hand ; so we use a brazed-up construction. All the component parts are shown separately. Two side plates are required for each crosshead ; these are cut from $\frac{1}{16}$-in. or 16-gauge bright steel, to the dimensions given. The centre-piece is made from $\frac{7}{8}$-in. $\times$ $\frac{5}{16}$-in. mild-steel bar. Part off a piece $1\frac{1}{8}$ in. long, in the four-jaw, or else saw overlength, and face off to the correct length in the chuck. Make a centre-pop dead in the middle, drill a $\frac{1}{8}$-in. pilot hole, and open out with 15/32-in. drill ; the unwanted metal between this and the end, is cut out by two diagonal cuts with a hacksaw, and finished with a file, leaving a " wide-open jaw " as shown. Carefully centre-pop the opposite end, and chuck in four-jaw with the pop-mark running truly. Put a $\frac{1}{8}$-in. pilot hole through first, and open out with No. 3 or 7/32-in. drill ; then, with a $\frac{7}{16}$-in. pin-drill, cut down to $\frac{1}{4}$ in. depth. This ensures that the flange of the boss will bed truly against the centre part. The rest of the metal is easily removed with a file, taking care not to spoil the faced seating.

The bosses are turned from $\frac{7}{16}$-in. round mild-steel, a simple job needing no detailing. Before parting off, centre each one and drill it $\frac{1}{8}$ in. to form a pilot hole for the piston-rod hole. You can't drill the latter right away, or it is goodbye to the little spigot which fits the hole in the centre piece, and locates the boss. This spigot should be a tight fit ; not a press fit, just tight enough to " stay put " whilst the brazing job is in process. To save making a small set in the drop-arms, cut them from a piece of $\frac{3}{8}$-in. $\times$ $\frac{3}{16}$-in. mild-steel, to the shape shown ; then file away 1/32 in. of top and bottom, on alternate sides, so as to bring them to the offset shape shown in the side view. Drill the hole in the lower end 7/64 in., and countersink it on the relieved side ; turn the shank of the pin to fit, then rivet over and file flush, as shown. The pin should be made from $\frac{1}{8}$-in. silver steel. Rivet the drop-arm to the side plate as shown ; two bits of domestic pins or bits of thin iron wire, will do quite well for rivets, as they only have to hold the arm in place whilst the brazing business is going on.



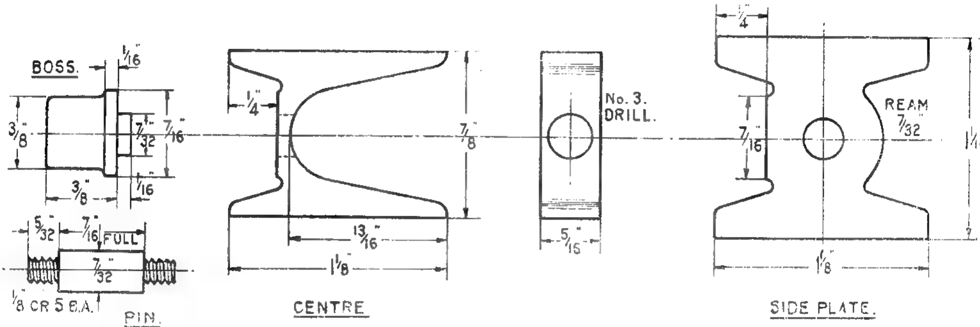
Crosshead and drop-arm

In the notes on assembling the crossheads for *Doris*, I said that the parts could be held together by a couple of small rivets, such as pieces of domestic blanket pins, put through both side

plates and the centre piece, close to the boss. These crossheads may be assembled in the same way, or a hollow rivet through the crosshead pin-hole may be used as an alternative. For the latter, chuck a piece of ¼-in. round steel rod in three-jaw; face, centre, and drill down a full ½ in. depth with No. 30 drill. Turn down ½ in. of the outside to a tight fit in the crosshead pin-hole, and part off at ½ in. from the end. Push the boss into the centre piece, then put a side plate on each side of it, making a sort of sandwich—not quite so palatable as the kind we used to get at the Sterling shop on Forty-second Street, but rather more lasting!—then push the hollow rivet through the pin-holes in the middle of the lathe, with the casting held against a drilling pad on the tailstock barrel, as they must be dead square with the crosshead, otherwise you'll have trouble with the little-ends. The crosshead pins are the same for either cast or built-up crossheads, and they are turned from 7/32-in. round silver-steel, as shown in the small detail sketch, which needs no explanation. Ordinary commercial nuts are used.

Connecting-rods

Neither time nor space need be wasted in detailing these fully, as they are made in the same way as the coupling-rods. Note that plain reamed bush holes are not only perfectly satisfactory,



Parts of built-up crosshead

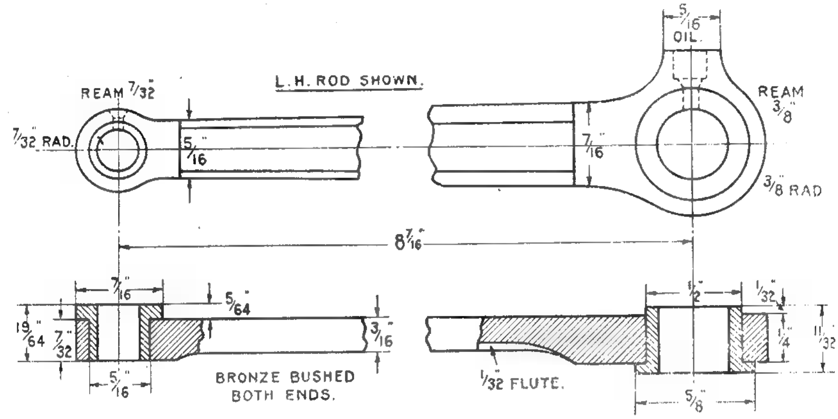
plates. Put the point of a fat centre-punch in the hole at each side, rest the other end on something solid, and give it a clout with the hammer. This will spread the end of the hollow rivet sufficiently to hold the assembly together whilst it is brazed. Procedure is as per usual; just anoint it with some wet flux, put it in the coke, blow to bright red, and touch the joints with a bit of thin soft brass wire, or a $\frac{1}{16}$-in. Sifbronze or similar rod. A friend sent me a sample of a Swedish product they call brazing-bronze, which I tried out on several small jobs like this, and it did the job very nicely, penetrating through the joints just like silver-solder. When applying the brazing material, imagine yourself on the board of directors of Cohen & McPherson Ltd. (with accent on the "limited"!) otherwise the recess will be partly blocked up, and the little end of the crosshead won't fit; vot you tink, eh? Hoots, mon, awa' wi' ye!

Let it cool to black, then quench out in clean, cold water (not pickle), clean up, drill out the hollow rivet with a No. 3 drill—you'll now see why it should be hollow, instead of solid—and ream 7/32 in. Also drill out the hole in the boss with No. 3 drill, and insert the "lead" end of a 7/32-in. parallel reamer in it, just far enough to allow the piston-rod to enter, a tight fit. If castings are used all the above fallals will be saved; all the castings will need, will be the grooves milling out exactly the same as described for axleboxes, the bosses drilled for the piston-rods, locating the holes as described for *Tich*, and the drop-arms made and attached by two small screws. The holes for the crosshead pins should be drilled either on a drilling machine, or in the

but desirable, when fitting coupling- and connecting-rods to crankpins. They don't need to be too close a fit, otherwise they try to bind when the axleboxes move. It is the same in full-size practice. On the L.B. & S.C.R. the driving bushes were simply bored to a running fit, and the others given $\frac{1}{16}$ in. clearance. Inside big-end brasses were "scraped" with a file, and the scratches all left in, to hold the oil. The consequence was, we ran from one year's end to another, without the slightest trouble; hot big-ends were practically non-existent, and wear almost negligible. A case was recorded of a *Gladstone* type engine running nearly fourteen years with the original coupling-rod bushes. Even in automobile work, the same thing has been found; plain boring and machining has taken the place of scraping. The old "Moocow" (Morris-Cowley) car which I purchased after returning from "over the big pond," had scraped big-end bearings, and they needed letting together and rescraping after about ten to twelve thousand miles of running. My present gasoline cart, a Series II Morris Twelve, has plain bored big-ends, an easy fit on the crankpins. She did nearly thirty thousand miles before a rattle developed; and nobody would accuse me of loitering when out on the road with her! Talking of scraped bearings, when Beardmore's built some 4-6-0s for the Great Eastern, just after the Kaiser's war, they "precision-fitted" the big-ends and coupling-rods in the "approved" manner; consequently every blessed engine kept failing on the road with hot bearings, and the whole bunch had to go into the shops, and the big-ends and bushes eased out to the usual clearances. Anybody who

follows suit on ■ little engine is just asking for trouble; experience still teaches!

The connecting-rods for *Pamela* are cut from $\frac{7}{8}$ in. × $\frac{1}{4}$ in. mild-steel bar (you can't beat good honest tough mild-steel, as used in full size) and all dimensions are given in the illustrations. However, note the arrangement of the bushes. The centre-lines of the piston-rod and connecting-rod, are slightly staggered, on account of the necessity of providing plenty of bearing surface for the bushes on the driving crankpins; and to maintain the connecting-rods parallel with the coupling-rods, the flanges of the bushes are placed on opposite sides. The big-end bush has its flange on the outside of the rod, in the usual way, although 1/32 in. projects on the inside, to keep the rod clear of the coupling-rod bush. The flange of the little-end bush is on the inside of the rod; and the combined thickness of rod end and bush flange, is 1/64 in. less than the distance between the two side plates of the crosshead. The inside, or back of the connecting-rod is quite straight; the outside, or face, is the full $\frac{1}{4}$ in. thick at the big-end, but has 1/32 in. taken off it at the little-end, for the purpose mentioned above. The intervening space is milled, planed or filed off to $\frac{3}{16}$ in. thickness, and further fluted to a depth of 1/32 in. For a posh job, the flute can follow the taper of the rod; but personally I never bother about such trivialities, making the flute parallel, end to end. It would take jolly good eyesight to spot whether the connecting-rods of my engines had parallel or taper flutes, or even any flutes at all, when they are doing the knots around my little railway. Incidentally, a few weeks ago, two more of the "full-sized" fraternity got what our transatlantic cousins would call ■ "big eyeful" on that same line. Driver Alf Oliver, who was a star turn on the Southern before his retirement, now editor of the *Locomotive Post*, and a well-known author, writer, and lecturer on locomotive matters, came along to "inspect the works," and saw the little compound *Jeanie Deans* at work. He said he'd never seen anything like it, in all his experience; and is going to use her as the "'orrible example" in a dissertation on compound engines. A main-line passenger driver of the Swedish State Railways, Allan Andersson, also came along at ■ later date, and tried his hand at driving my little L.N.E.R. *Tishy*. He had never seen a weeny locomotive in steam before, and was astounded. I guess when he got back and told his fellow-conspirators in Sweden about it, they thought he must be some relation to the party of the same name, who wrote the fairy tales! Both drivers made the same remark that has so often been made before, that the realistic working was uncanny; and Driver Oliver said that he believed that there was some understanding between the engine and myself. Well, the old boss used to say that I was a locomotive in human form; so if I meet with any untoward happening, I guess they will call out the breakdown gang, instead of the ambulance, and I'll wake up to find myself at Brighton, Ashford, or Eastleigh, instead of the local hospital!



Connecting-rod

How to Erect the Cylinders

The full ritual for cylinder erection was given in connection with the cylinders for *Tich*, and *Pamela's* cylinders may be erected in much the same way. The correct location is easily found. As an additional check when locating, scribe the centre-line of motion on each frame, from centre of driving axle to front buffer beam, exactly as described when marking out the frames. This line rises approximately $2\frac{1}{2}$ deg. from the horizontal, starting at centre of driving axle in running position, that is $\frac{5}{8}$ in. from bottom edge of frame, and cutting across the buffer beam at 3/32 in. from the top edge of it. Scribe ■ line across the bolting face of each cylinder, level with centre of piston-rod, and make a small centre-dot on the cylinder block, at each end, exactly level with the ends of the line. All you have to do, to set the cylinder in correct position, is to put it against the frame, with the two dots exactly over the centre-line of motion, marked off as above, and the front end of the cylinder casting $2\frac{7}{8}$ in. from front edge of frames (back of buffer beam) at the point where the dot is. The distance from "dot level" to top of frame at front end of cylinder, is 2 3/32 in., and at back of cylinder, $2\frac{3}{16}$ in.; ■ slope of 3/32 in., in $2\frac{7}{16}$ in., the length of the

(*Continued on page* 836)

Mr. J. N. Maskelyne in the West Country

ON the evening of April 21st, the Technical Editor of THE MODEL ENGINEER was a very welcome visitor to the Newton Abbot society's headquarters at the Penguin Inn, Newton Abbot, and was "pounced upon" almost as soon as he entered, by members, eager to talk "locomotives."

Mr. Maskelyne showed great interest in the display of locomotives in various stages of completion, arranged for his inspection, and commented on the workmanship which he considered was consistently of a very high standard, especially in the society's 5-in. gauge club locomotive chassis and tender.

The society's C.M.E., J. Curtis, explained the working of the semi-radial axle boxes and big-ends, which he had schemed out and adopted in the construction of the locomotive. Mr. Maskelyne had great praise for the idea and workmanship put in by the members who have taken part in its building, and looked forward to trying them out on the society's track when completed.

The C.M.E. demonstrated the locomotive working on air pressure, which was a big thrill for the members, as it was the first time they had seen their locomotive "turning over." By all accounts, they were more than satisfied with what they saw.

At last, the members settled themselves comfortably and allowed Mr. Maskelyne to give his talk on "The Construction of Locomotives to Scale," after which he kindly consented to become a one-man "Quiz" and answer any question "fired" at him. Several questions were asked, but members appeared to have already worn themselves out by talking earlier in the evening.

The talk was illustrated by photographs projected by an episcope made for the occasion by Treasurer S. Haydon.

Finally, Mr. N. P. Roberts, president of the society, thanked Mr. Maskelyne for coming all the way to Devon to give such an interesting talk which was enjoyed by everyone.

J.N.M. finds something unusually interesting at Newton Abbott

AN UNUSUAL TURNING TOOL-HOLDER FOR SLENDER WORK-PIECES

by W.M.H.

Describing a very interesting type of lathe tool-holder employed with much success for guiding and supporting rods of very small size whilst reducing them to a very slender diameter

VERY often the engineer is called upon to reduce (by turning) the diameter of rods, pins, or studs, etc. for a certain length, when the outside diameter of such parts is already very small in size. If the depth of cut to be taken on such components has to be of substantial magnitude it may be found that considerable difficulties will arise during the turning operation in respect of the following points.

(1) Errors, Faults, and Delays Associated with Customary Methods, and Tooling

For example, with components of such slender proportions it will often be impracticable to employ the customary centre-hole up the end of the rod being turned, owing to the smallness of the diameter of the original rod, or the size it is desired to reduce such a part. Consequently, the ordinary centre-bit cannot be used in the lathe tailstock to support and steady the rod against deflection whilst under the cut.

Should a piece be turned without such ■ centre-bit support there will be considerable tendency for the workpiece to deflect and bend due to the lateral pressure arising from contact with the cutting tool. Three major forms of error would therefore accrue. These are :—

(*a*) In the first place the turned portion would not be concentric with the original unturned diameter of the rod.

(*b*) The machined portion may not be turned perfectly cylindrical.

(*c*) Thirdly in respect of the parallelism of the slender turned portion it may be found that serious errors would arise, again partly due to the deflections of the rod, and the inability to take ■ substantial depth of cut.

Ovality, taper, and eccentricity of the above character would of course be most liable to spoil the whole workpiece. On the other hand, the turner in his efforts to avoid such faults might have to expend a very considerable amount of time, attention, and effort in performing such delicate turning operations. It would in practice be necessary for him to take ■ large number of passes along the turned portion of the rod, each one being of a very small depth of cut so as to obviate placing any undue load upon the slender unsupported portion of the rod.

(2) Construction of a Special Supporting Tool-holder

To overcome the aforementioned kind of difficulties, when having to deal with a large number of small diameter pins requiring reducing at one end for about half the overall length, down to ■ very slender size, the author developed and used a most interesting type of tool-holder having a supporting guide provision for the rod. This was found invaluable for avoiding the troubles just enumerated in connection with usual turning methods.

The diagram, Fig. 1, depicts two views of the complete tool-holder. Referring to the right-hand front elevation view, it will be noted that the holder consists of a stiff rectangular shaped steel bar *A*. This member is reduced to less than half thickness and ■ slight amount in width for about half its overall length in order to provide a gripping shank *B*, by means of which the tool-holder may be fastened in the lathe tool-post.

The full thickness portion is slotted centrally for a given depth in the manner shown. The left-hand side portion is drilled and reamed to take the hardened and ground guide bush *C*.

This member should be made ■ tight press fit within the bearing hole in the holder. A similar smaller bush as shown at *D* is situated in like manner in a drilled and reamed hole passing through the right-hand side of the slotted portion.

The respective holes in which these two bushings are housed should be machined perfectly in axial alignment in both planes, in order that the bores of the bushes, when mounted, shall in turn lie exactly in line with each other. A rod component when turned to the requisite size should be capable of revolving freely within the bush members without tightness or interference.

Element *E* is the cutting tool which should be made from the usual standard size rectangular tool-steel. This is situated within ■ parallel rectangular slot machined into the top face of the tool-holder *A* as shown. This slot should be located exactly at right angles to the horizontal centre line passing through the bushings *C* and *D*, or in other words at right-angles to the rod component held in the chuck. The tool should be made ■ very snug sliding fit within its slot.

The tool is capable of being locked in any desired position within the capacity of the slot length by means of the square-headed set screw *F* situated in a tapped hole machined through the right-hand side wall of the slot.

To prevent the tool from lifting out of the slot ■ mild-steel keep-plate *G* is employed. This member is secured down to the top face

of the holder by four vee-head screws *H*. With this keep-plate thus fastened in place, the tool should be capable of moving smartly within the slot with a minimum of working clearance, when set screw *F* is released, and pressure is applied to the rear end face of the tool in a manner now to be described.

A well-fitted tool in this fashion will greatly promote the reproduction of high quality finish and close accuracy on the finished workpiece by reason of the elimination of tool vibrations, or deflection out of the proper cutting position, which vibrations etc. would be transmitted to the turned portion of the bar.

To provide a simple means for adjusting the tool relative to depth of cut required, a small endplate *I* is fastened permanently to the step formed at the junction of the shank portion *B*. Threaded through a tapped hole in this plate is the adjusting screw *J*. As will be noted this member is located so that it will bear centrally against the rear endface of the tool.

By rotating this screw *J* in a clockwise direction the tool will be advanced closer to the work, thus causing a deeper cut to be taken. Conversely, by releasing the screw a slight amount the tool may easily be retracted away from the work to allow for increasing the diameter on the turned portion.

For preference, this screw *J* should be of very fine pitch to enable fine degrees of adjustment of the foregoing kind to be effected.

(3) Application and Use of the Tool

From this description of the design and construction of the tool its method of use and action will have been made clear.

This can best be described briefly by selecting an actual example. Suppose for instance it is desired to reduce a $\frac{3}{16}$ in. diameter silver-steel rod down to $\frac{1}{8}$ in. diameter for a length of say 3 in.

It will first be necessary to grip the rod in the ordinary self-centring three-jaw chuck, taking care to have the rod running exactly true.

Two suitable guide bushings would then be required, one having a bore diameter of $\frac{3}{16}$ in. for mounting in the left hand side of the holder nearest to the chuck, through which the rod should pass freely but with a minimum amount of working clearance. A second bush would be mounted in the right-hand wall of the slotted part of the holder, having a bore diameter of $\frac{1}{8}$ in.

The rod would next be carefully turned down for a short length to the required size, this operation of course, being performed with the member running within the left-hand bush *C*.

It would be necessary to adjust the lathe cross-slide laterally in order to bring the leading bush *C* exactly in axial alignment with the rod, before commencing a cut.

After the necessary trial cuts have been taken to determine the correct size of turned portion on the rod, cutting operations proper may be commenced. When a very short length of cut has been taken along the rod the reduced portion will be long enough to enter into the bush *D* whereupon still additional guidance and support will be presented to it.

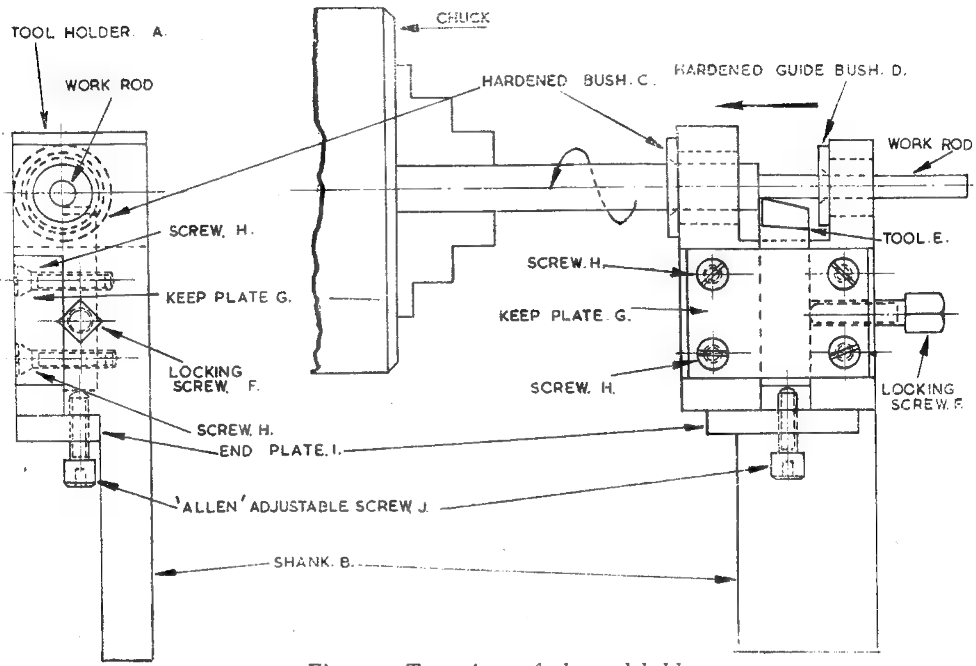


Fig. 1. Two views of the tool-holder

The finished turned portion formed in this manner should then be free from ovality, taper or eccentricity with the original outside diameter of the rod.

Practical Advantages

A number of valuable advantages are to be derived from the use of a tool-holder of this design. Briefly these advantages will be as follows :—

(*a*) Use of such a holder will greatly reduce the risk of error, particularly on small diameter work.

(*b*) If the holes in the slotted portion of the holder, required as housings for the guide bushes, are machined to the correct standard size to receive ordinary hardened and ground *drill guide bushings*, very considerable economies will be obtained. Bushings of this well-known type are easily obtainable in a wide variety of bore sizes, from specialist manufacturers, at very economical prices. Moreover, the sizing of bores with such components will be to guaranteed limits.

These items may be bought at much lower prices than the cost of manufacturing same in one's own works, unless very large quantities can be produced at a batch.

Headed bushes of the kind illustrated in the diagrams will be found to give best service.

(*c*) If the adjusting screw *J* is made with fine pitch threads, fine degrees of adjustment will be possible to the cutting tool.

(*d*) Because of its simple construction the task of mounting up such a holder, complete for any particular size of turned job, will be very easily and rapidly accomplished.

(*e*) If the essential portions of the holders, such as the adjusting screws, keep-plate, and locking screw, etc. were to be case-hardened before use, the initial accuracy would be retained and the durability of the entire tool enhanced.

(*f*) When using a supporting tool-holder of this character it will not be necessary to drill up the end of the workpiece to take an ordinary centre bit, since additional support afforded by such an element will not be required.

(*g*) In those cases where long runs of identically turned rods have to be dealt with a tool of this kind will be found especially useful in that the tool can be retained set in the correct position for sizing the rod accurately, whilst the guide bushings will determine whether the diameter of the bar is inadvertently increasing.

(*h*) Such a tool-holder may be used in most types of lathe, and if an adequate supply of guide bushings is provided, a very wide range of work can be handled satisfactorily and efficiently.

"PAMELA"

(*Continued from page* 832)

finished cylinder casting. If the chassis is laid on its side, the cylinder rests on it by its own weight, and adjustment is just a piece of cake. When you get it right, put a big toolmaker's cramp over cylinder and frame ; then check with a piece of sewing cotton, same as young Curly used to do when setting his little toy oscillating cylinders. Pull out the piston-rod as far as it will go ; the piece of cotton, about 1 ft. long, is stretched taut, and held exactly over the centre-line of piston-rod, at one end. If the other end passes exactly over the centre of driving axle in running position, the cylinder is set O.K. If not, it is a simple matter to adjust it until it is correct. Tighten cramp, and locate the screw-holes on the bolting face by aid of a long drill poked through the holes in both frames, as described and illustrated in the notes on *Tich* ; drill No. 40, and tap $\frac{1}{8}$ in. or 5 B.A.

Give the second cylinder a dose of the same medicine ; then, if you haven't already done it, screw the guide-bars on, put the crosshead between, with the boss just sufficiently over the piston-rod to prevent it falling off, and put the guide-bar brackets over the bars. Put each assembly in place, securing the cylinders temporarily by two or three screws, just enough to stop them from shifting. Set the guide-bar brackets in their correct position, that is, the front edge of the channels at $2\frac{1}{8}$ in. from the cylinder cover. This gives ample clearance for the wheel flanges. Set the crossheads exactly between the jaws of the brackets ; then put a toolmaker's cramp over the flange of each bracket, and the frame. Now see if the crossheads move up and down between the bars easily ; if they do, the location of the brackets is correct. You can attach the brackets to the frame, either by drilling No. 34 holes through it, using those in the bracket flanges as guides, and fixing with 6-B.A. bolts ; or make No. 34 countersinks on the frame, drill No. 44, tap 6-B.A., and use set-screws.

Still keeping the crossheads between the jaws of the brackets, poke a No. 30 drill down the holes in the channels, and make countersinks on the guide-bars. Shift the crossheads out of the way, drill the bars No. 40 at the marked spots, tap $\frac{1}{8}$ in. or 5-B.A., and fit set-screws, filing off any threads projecting below the bars. Finally, pin the crossheads to the piston-rods. Push the piston-rods right home, so that the pistons are hard up against the front cylinder covers ; then put the crank on front dead centre, the crosshead boss passing over the end of the piston-rod. Scratch a mark on the piston-rod exactly $\frac{1}{16}$ in. from the crosshead boss. Take off front cylinder cover, and very carefully drive the piston along, with a hammer and a bit of hard wood, or something similar, until the rod has entered the boss another $\frac{1}{16}$ in., and the mark is level with same. Then pin the crosshead boss to the piston rod by drilling two No. 43 holes through the lot, as close together as possible, and squeezing in two pins made from 3/32-in. silver-steel. Don't bother about putting all the cylinder fixing screws in yet, as we shall have to take the cylinders off, to fix the exhaust pipe ; this can be the next job.

*TWIN SISTERS

by J. I. Austen-Walton

Two 5-in. gauge locomotives, exactly alike externally, but very different internally

SOMEBODY has asked me to define my future policy regarding locomotive articles; I cannot very well say that I have not *got* a working policy or general scheme, but much depends on my readers' likes and dislikes.

It has been said also that, had "Twin Sisters" been any other type of engine, there would have been many more builders. As far as I can make out, there must be about eighty "Sisters" on the stocks by now, which isn't bad for a start, and one must make allowances for those who are a bit frightened about building an engine described by a more or less new writer.

It is pretty well common knowledge that friend "L.B.S.C.'s" engines do the job required of them, except perhaps in some cases where sheer bad, or careless workmanship on the part of the builder prevents good performances—one cannot blame the designer for this sort of thing. In this respect, I fully expect to be accused of misleading builders with regard to final performance, where perhaps the fault may well lie with the builder.

Let me reassure my own locomotive followers in this way; if the engine is built to drawings and descriptions, there is simply no question of the engine not working and steaming in the most satisfactory way.

So Near and yet so Far!

For example, my own wife built a *Marina*, of "L.B.S.C.'s" design, some time ago—a remarkable effort in many ways—and a genuine "all by herself" attempt, including the brazing of the boiler, which episode, by the way, chopped a clear ten years off my expectations of life; but she finished it and took it to the Malden track to have a trial run. Steam was raised, but wouldn't stay up for more than a few minutes. I did manage to get it to take me one circuit of the track, finishing up with a dead fire, in spite of performing all the old tricks known to locomotive drivers.

She was told by those who were present, including myself, that the blast and blower were wrong, and that she would have to fiddle until she got it right—so far she hasn't had the heart to do the "fiddling" and I refuse to do it for her, knowing that she is well capable of doing the job herself, especially as she built the entire engine.

I did use the engine in question, for a "guinea pig" experiment, and fitted it with a new type of atomising paraffin burner, just to see what it would do; it steamed well enough then, reaching blowing off point in just under three minutes from all cold, and holding it when working under full load conditions, which demonstrated that the engine itself was all right.

I have seen other engines, excellently built, but discarded as useless, just because the maker couldn't take enough trouble to get the blast pipe positioned correctly, or with a crude type of single jet blower, also badly placed and much oversize in jet orifice, which nearly emptied the boiler every time it was turned on.

A correctly designed blower doesn't need to roar its head off to be fully effective. On my own *Centaur* the blower can hardly be heard, and more than once when working out of doors at some fete or other, I have had to get down from the driving seat to listen close to the chimney, just to hear whether it was working at all. She has a big boiler—*not* oversize, as some people have been led to believe—but dead to scale. I have had her in steam for eleven hours non-stop, hauling train loads of eighteen adult passengers at roughly two minute intervals, and with the track thrown down in a field with a 1 in 80 gradient, which I couldn't be bothered—or didn't have the time, to correct. *Coal consumption for the whole day*—just the full tender with which I started.

When I was running at the Woking Carnival, I had a better pitch where the gradient was 1 in 100, and knowing the hauling capacity of the engine, I didn't bother to search for wood packing to take this out. There were many other "side shows" at the Carnival, and the weather was exceptionally hot (so were the wasps), and being at the end of the huge field, they were very tired and weary passengers who came at last upon the railway. Noticing that poor old *Centaur* was puffing a little harder than usual, I took a look back at the "train"—twenty hot and tired adult passengers were trailing their feet in the long grass and along the ground beside the track—too tired even to hold them up for such a short journey! So what this extra braking effort was in terms of resistance per ironclad army boot, I cannot say, but the engine took it in near middle gear, and hardly more than an extra $\frac{1}{8}$ in. on the regulator handle—enough has been spoken!

The Prophet is not Without Honour

But this is leading me far away from the original topic, which was, I think—*Marina*. Why didn't Mrs. A-W build one of my engines? Let's ask her: "Build one of *your* complicated engines, with all those drawings and stainless-steel and things?—not —— likely, who do you think you are—Stanier?"

"Not Stanier," I replied. "What about Smellie?" We agreed on this without trouble (or definition). But all the same, I know

*Continued from page 768, "M.E.," May 25, 1950.

somebody whose firehole door fell off, just because she wouldn't use stainless-steel studs—*I* know somebody!

But now I am going to let another secret out of the bag; my good lady rather fell for a pretty picture post card of one of Bagnall's 0-8-0 tank engines, built for South Africa and therefore 3 ft. 6 in. gauge. I told her that in 1 in. scale it would be dead right for $3\frac{1}{2}$ in. gauge, so she wrote to Bagnall's for drawings and they were most kind and helpful, sending a whole bag of prints, many already in 1 in. scale (some people do have luck, don't they?).

She made the frames, buffer planks, wheels, horn cheeks, and a few other bits; then she made me do some more drawings. Then she left the parts strewn all over my favourite bench; then she turned over to the "fury of knitting," and hasn't been seen much in the workshop since, except to collect empty tea cups and remind me of what I haven't done in the house for the last six months. I hoped that at least the knitting effort might turn out to be a Fair Isle cosy for a 2F—it wasn't, it was something very ordinary. Oh well, experience has a way of instructing us!

Down sir,—to Heel!

Oh yes, I nearly forgot—this question of future policy. If you love locomotives as I love them, you must have your pipe dreams, many of which you know will never come true, but it is just nice having them all the same. If I were building for purely sentimental reasons, I think I would go in for one of Sharp Stewarts' 3 ft. 0 in. gauge engines, such as the "Halesworth" No. 2 or "Blyth" No. 3 2-4-0 tanks. I think No. 1 was the "Southwold," a 2-4-2, and all these ran on the old Southwold line. They were finished in the Great Eastern livery—blue with a neat red lining; oh, shades of friend Emmett and all the delightful locomotive lore that he upholds—think of this little engine in true scale (near 1 in.), complete with all the details that mean so much. This is the sort of job I would like to build in $7\frac{1}{4}$-in. gauge, if I had the track to suit, and if my poor old back would do the lifting—which it won't any more.

But would such an engine be a popular "serial"?—I doubt it, especially in these days. Short of streamlining (for which personally I have no use at all), the modern locomotive builders have a leaning more towards the squat, slinky express types—all breathing fire and speed, and with chimneys like the rim off a milk bottle, and domes rather like gnat bites. Strangely enough, I can digest the brutes up to this stage without much trouble, but they must still *look* like locomotives.

One of my more advanced pipe dreams embraces the more modern type, with low chimney, and well faired in dome, and the cab merged into the firebox lagging; this is my new poppet valve job. I can see her completed—a shining vision of Caledonian blue, lined with red and white, as fine as a strand of cotton, and an eight wheel bogie tender with high, clean sides, and the turned in flaring fading out to a long after platform for water fittings and vents. Three or four cylinders?—I don't know yet; she is, in a sense, already on the drawing board, and some details have been settled. But who would build a 5 in. Pacific in these expensive days, especially to my rather exacting specifications?

The only way I can find out the needs of the locomotive building folk, is by asking you to write me on the subject. I could not, of course, answer the letter, but I could compile a dossier which would be a very revealing collection of information, to say the least of it, and it might be possible to extract a definite clue.

You may think that these are early days to start talking about another engine, especially with the "Sisters" being so far from completion, but really well-detailed engines take a lot of knocking into shape before they are ready for presentation to the public, and much work and stocks of drawings must be prepared before the engine takes its bow in print. The present series is very much of a "hand to mouth" business, with few allowances for the eventuality of the designer falling sick for any period.

It *does* have its compensations in that experiences in the building can be shared by builders and designer alike—this is fortunate for you, and—distressing for me—at times.

"Twin Sister" No. 1 should be ready for running on compressed air, by the end of next month, and perhaps "Twin Sister" No. 2 as well. I have the most time, and Duncan has the most health, so it might be a neck and neck race. This event will denote the approximate half-way line in construction; time enough to think about getting the next job on the way.

This Week's Afterthought

I must get back to work, and I have a "stop press" observation to make concerning the front sand boxes.

We were placing these in position one evening last week, just to see how the sand pipes would work out. These pipes must go in front of the forward brake stretcher, at the same time sweeping outwards to come into line with the rail head and the wheel. Knowing that short double bends in small copper pipe are stumbling blocks with many builders, I sensed a certain amount of trouble brewing up. There isn't much room to play around in these rather close quarters, and I am going to suggest the fitting of a small *round* elbow at the bottom of the box. instead of running the pipe direct from this point. A hard, square elbow would be quite out of the question, as the sand would be trapped in the bend.

A small round bend, not taken to the full right-angle, and with about a $\frac{3}{8}$ in. inside radius, should fill the bill, and give the pipe a fair run downwards and forwards. The pipe union would be made on to the outlet of the elbow instead of being fixed to the bottom of the box, to facilitate erection.

The union nipples called for as simple rings of brass or bronze, and not shown on the drawing, might also be troublesome to make; they would have a $\frac{3}{16}$ in. bore, by a 7/32 in. outside diameter—the tapping size of the union nut—just a wee bit flimsy, eh?

I suggest spinning or knocking over the end of the pipe to provide a sort of ridge, which

would be quite sufficient to provide a hold on the fitting. There are no steam-tight joints to worry about, but some degree of vacuum in the pipe when working. Jointing material in some form should do the necessary here, perhaps a few strands of anointed cotton behind the "ridge," and some on the threads of the union nut itself. The pipe is supported by a stay farther down, so that mechanical strength is assured. The most important thing is to see that the pipe has an unrestricted internal bore, including those parts where fittings interrupt the run.

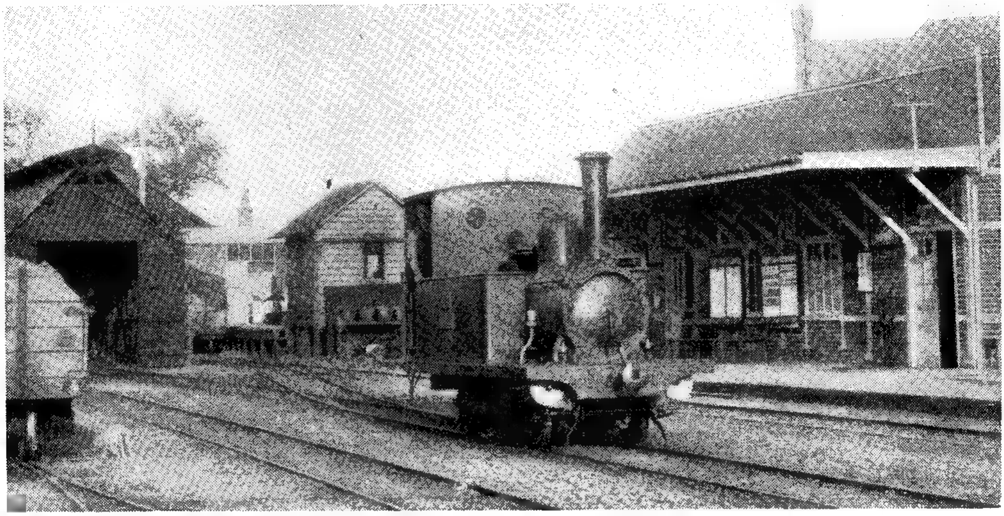
The Big Strip Tease

If you are right up to date on all details, now is the time to take the engine to pieces entirely, and, we hope for the last time before having a run on compressed air or steam.

Our object now is to perform the drillings for the cylinder holding bolts, drill the sand box stay fittings, drill for the sand boxes themselves, fit the bracket for the brake cylinder return spring, and one or two other small jobs that will be enumerated later on.

The cylinders, guide bars, motion plates, valve crosshead brackets, expansion links, etc., will all go on the engine *as one complete unit*, and with the frame side laid flat on the bench for marking, measuring and drilling—very convenient, and a great aid to general accuracy.

It is a very simple set of valve-gear to erect, especially in its unit construction form, and I propose to describe one or two quite simple jigs, which will help you still more with the positioning of the various parts. I hope you will realise—especially the "first timers"—that you may make all the parts quite accurately and entirely to drawing, and yet position them incorrectly on the frames, so producing the quaintest results in your valve event, and I shall not fail to emphasise the danger points as we come to them.



One of the engines of the old "Southwold" line

I had hoped to include two sketches with this issue, one dealing with the cylinder fixing holes, and the other giving details of the spring return system, but somehow my visit to the hospital this week has put me back, and I don't want to risk failing you with the usual instalment.

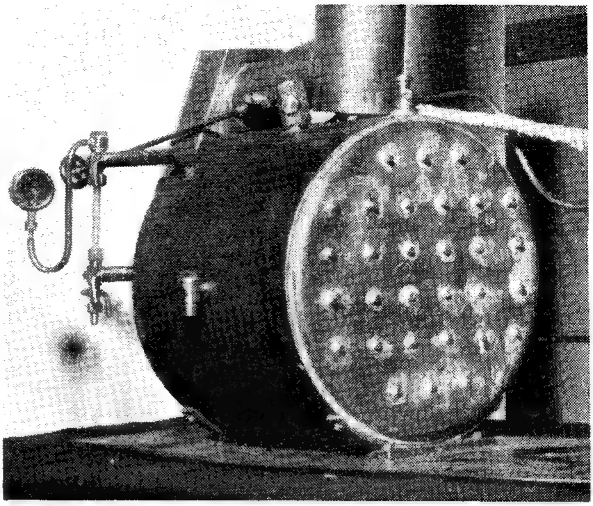
I hope you like the picture; I borrowed this from a friend, and simply couldn't resist putting it in—are you there, Mr. Emmett?

(To be continued)

A C.M.E.'s Exhibition Model

We learn that, this year, there will be on view at THE MODEL ENGINEER Exhibition a fine 2-in. scale locomotive that is of more than usual interest. We do not often hear of a Chief Mechanical Engineer who has built a working model of one of his own locomotives, but Lt.-Col. L. B. Billinton can certainly be given this distinction. Since his retirement in 1922 from the position of Chief Mechanical Engineer to the London, Brighton and South Coast Railway, he has been engaged in the construction of a 2-in. scale replica of one of his Class K, 2-6-0 express goods locomotives, and we are pleased to say that he has been kind enough to send us many photographs which show most of the principal details at various stages from the start to the finish of what is unquestionably a magnificent model. We intend to publish a comprehensive selection of these photographs, together with some constructive notes which the illustrious builder has provided. But we are also pleased to hear that the finished engine and tender will be entered in the Competition section of the exhibition.

AN UNUSUAL STEAM-PLANT



WE have had an opportunity of inspecting an unusual steam-plant made to special order by Bond's o' Euston Road, for ■ customer who required ■ coal-fired boiler for his model tugboat. The engine, as can be seen in one of the illustrations, is a Stuart Twin with cylinders of $\frac{3}{4}$ in. bore by $\frac{3}{4}$ in. stroke, but the boiler was designed and built by Bonds to suit the somewhat confined space below the upper-works of the model tug, the hull of which is about 4 ft. 6 in. long.

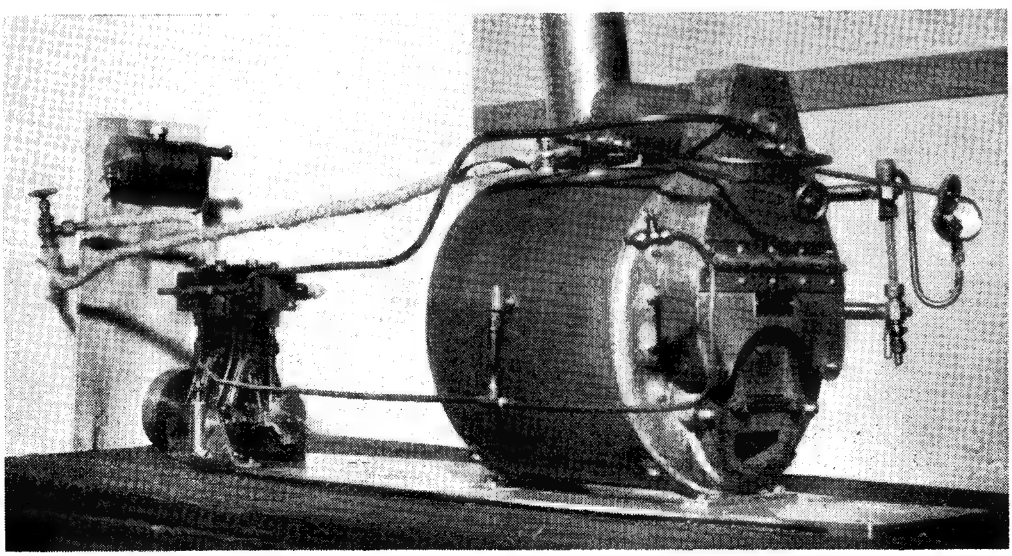
The boiler is of Scotch type and is equipped with a combustion chamber. There are fifteen longitudinal stays and fifteen end stays in the combustion chamber; the entire boiler, which is made of copper, is silver-soldered. Its diameter is 7 in. and the length is 6 in. The furnace tube is 3 in. inside diameter, and there are twenty-two flue tubes of $\frac{3}{8}$ in. outside diameter.

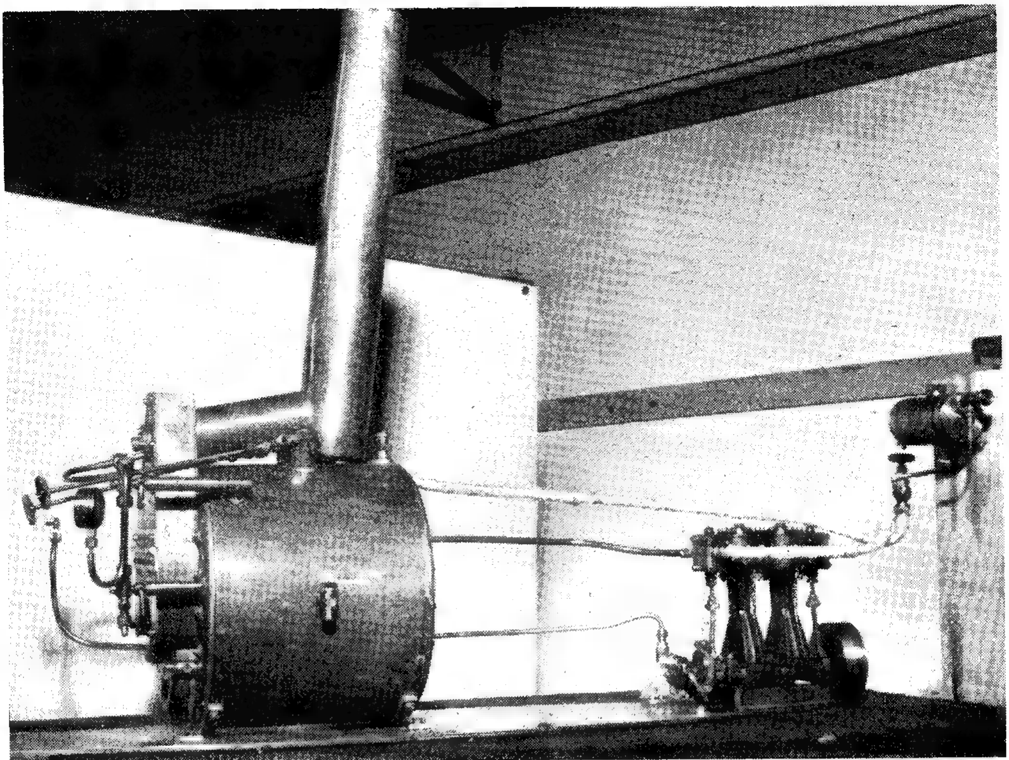
The dimensions seem to have produced ■ very satisfactory steam generator; we saw it started up from cold, and although we did not actually time it, steam was raised in about twelve minutes, under forced draught. Thereafter, the boiler's own blower sufficed to maintain a plentiful supply of steam against the demand of the engine. The working pressure during the test was 60 lb. p.s.i., and the safety-valve was blowing off most of the time.

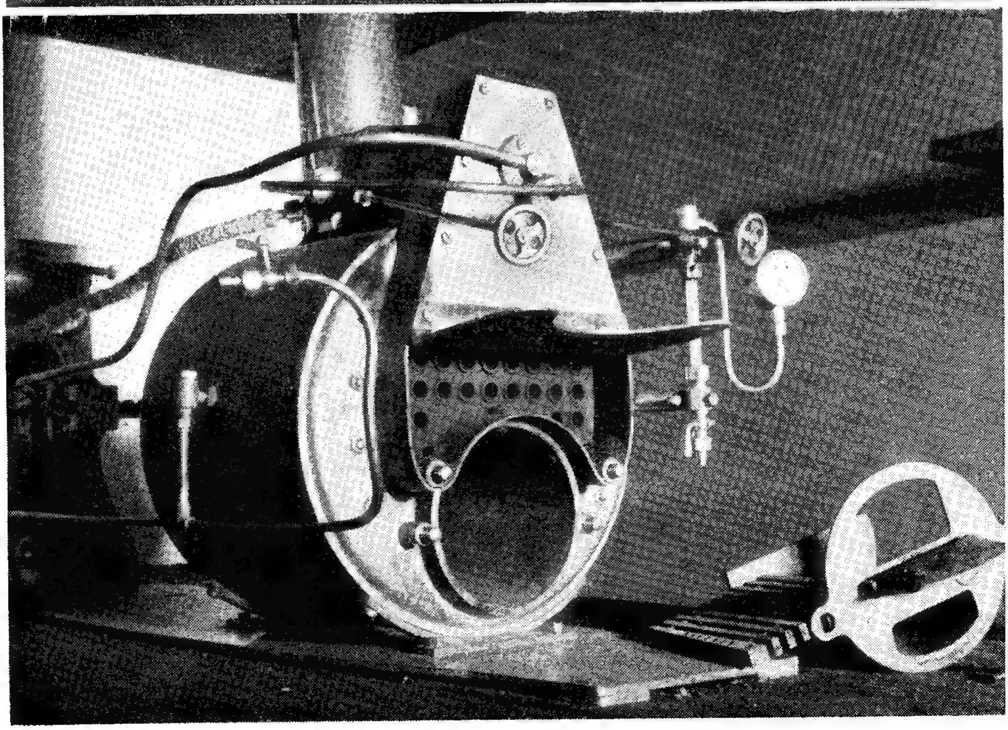
The engine is equipped with an eccentric-driven feed-pump, the capacity of which is more than enough to keep the boiler supplied with water. Other fittings include the usual pressure-gauge, water-gauge and blower-valve. The grate is removable and the smokebox is provided with a hinged front which can be lifted to expose the tubes for cleaning purposes.

During the test which we observed, the fire was started with charcoal soaked in methylated-spirit, and after it had become a glowing mass, it was kept going on a mixture of anthracite and household coal. This required only sparing use of the blower and produced quite a realistic amount of smoke.

It is ■ long time since we saw ■ coal-fired miniature marine plant in action, and we hope that the owner of this one will favour us with an account of its behaviour in service, as well as a photograph of the model tug in which it is installed.







Novices' Corner

The Test Indicator in Use

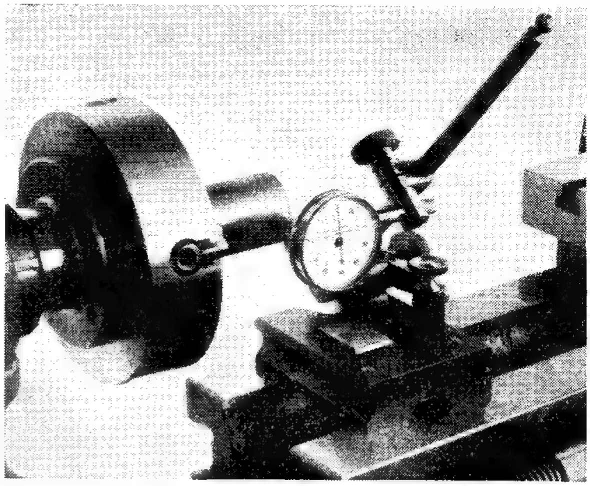


Fig. 1. *The dial test indicator in use on the lathe bed*

THE most common use to which the test indicator is put is, perhaps, that of setting work to run truly in the four-jaw independent chuck, and, as difficulty is sometimes experienced in carrying this out quickly and accurately, it may be as well to describe the necessary steps in detail.

Centring Work in the Chuck

Setting a round bar in the chuck will be taken as an example, but the method used will equally well apply to centring irregular work by means of a centre-finder or wobbler. In the first place, the bar can be gripped nearly centrally in the chuck by taking note of the position of the chuck jaws in relation to the concentric circles machined on the chuck face. Next, mount the test indicator on its holder in the lathe toolpost and turn the mandrel by hand while the cross-slide is fed slowly inwards. If a dial test indicator is used,

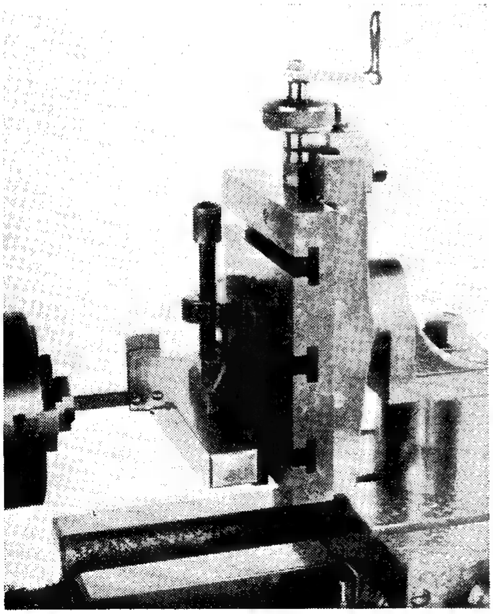


Fig. 2. *Method of aligning the front face of the work*

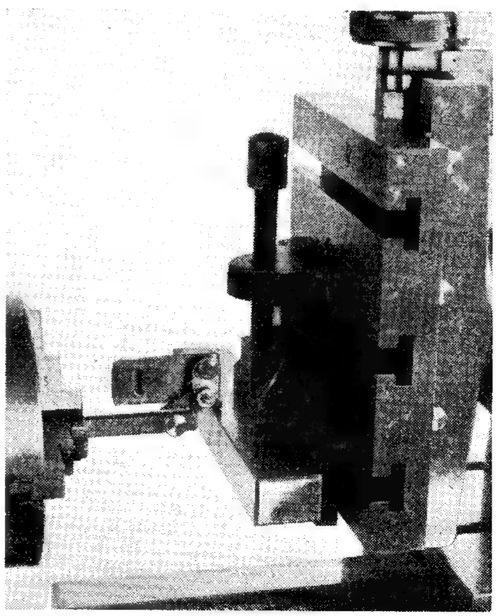


Fig. 3. *Aligning the upper surface of the work*

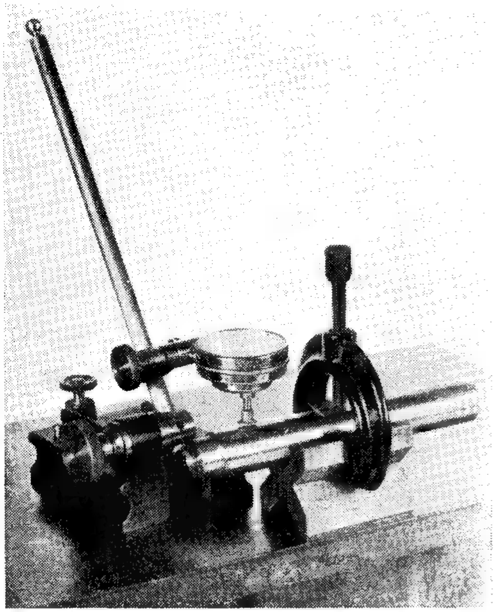


Fig. 4. Setting a shaft parallel on the surface plate

having a measuring range of some $\frac{1}{4}$ in., it will probably be possible to record both the high and the low places on the bar at the initial setting. But if the indicator has a range of only 15 thousandths of an inch, then the cross-slide must be stopped when a reading of, say, 10 thousandths has been obtained at the highest place on the bar.

Turn the mandrel until the lowest place on the bar is opposite to the button of the indicator; the width of the gap will then serve as a guide to the amount the work is out of centre. Now slacken the jaw near the low spot and tighten the opposite jaw. Repeat these operations until both the high and the low places on the bar are shown on the scale of the indicator.

As soon as the total eccentricity is recorded by an uninterrupted movement of the indicator needle, the setting operation becomes much easier. Next, turn the mandrel until the high place is shown on the scale; slacken the opposite jaw and tighten the near jaw until the indicator shows that half the total eccentricity has been removed; tighten the opposing jaw so that the work is gripped. This setting process is continued until the indicator needle remains stationary when the work is rotated. Should the eccentricity be found to lie mid-way between two jaws, adjust, first, one pair of jaws and then the second; this will ensure that the work is always supported by one pair of jaws and not allowed to become loose in the chuck. Finally, all the jaws are fully tightened, but meanwhile the indicator should be kept in contact with the work to make sure that no displacement takes place.

It may need a little practice to centre a part in this way, but, with methodical working, each adjustment of the chuck jaws should bring the work nearer to the centre.

Where irregular work is centred by means of a centre-finder engaged in a centre hole drilled in the part, the process is exactly similar, except that the indicator is set to make contact with the centre-finder and not with the work itself. Should a cylinder have to be centred with reference to its bore, this can be done most conveniently by using the special internal contact device with which both the Unique and the dial test indicator are equipped.

When centring work held in the chuck, the surface gauge may be used, instead of the toolpost holder, for mounting the test indicator and, as shown in Fig. 1, the base of the gauge then rests on the lathe bed. To locate the gauge, the two register pegs fitted to the base are pushed down so that their projecting ends can be brought into contact with the saddle guiding face on the lathe bed. The test indicator, when mounted either in the toolpost or on the lathe bed, can also be used to test the true-running of the surface of the lathe faceplate, or that of a chuck or other fitting attached to the lathe mandrel.

Aligning Work on the Lathe Saddle

It is often necessary to set work attached to the saddle so that it lies truly in relation to the lathe axis. For example, work held in a machine vice attached to the vertical milling slide may have to be set so that both its front and upper surfaces are truly lined up with the axis of the lathe mandrel. Fig. 2 shows how the test indicator, when mounted in the chuck, is used for setting the front face of the work. The button of the indicator is brought into contact with the work,

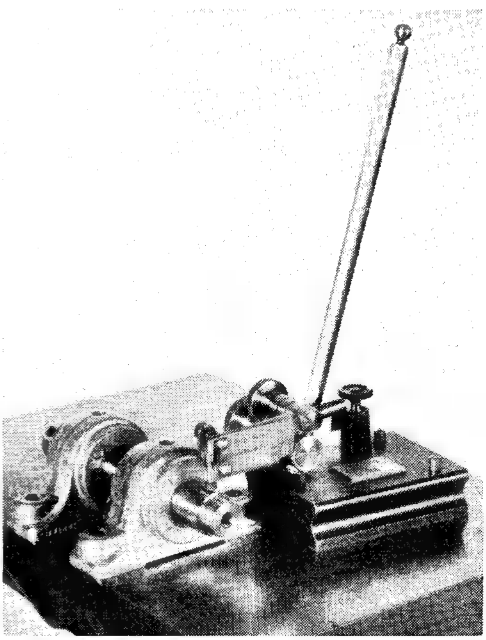


Fig. 5. Testing a pair of plummer blocks on the surface plate

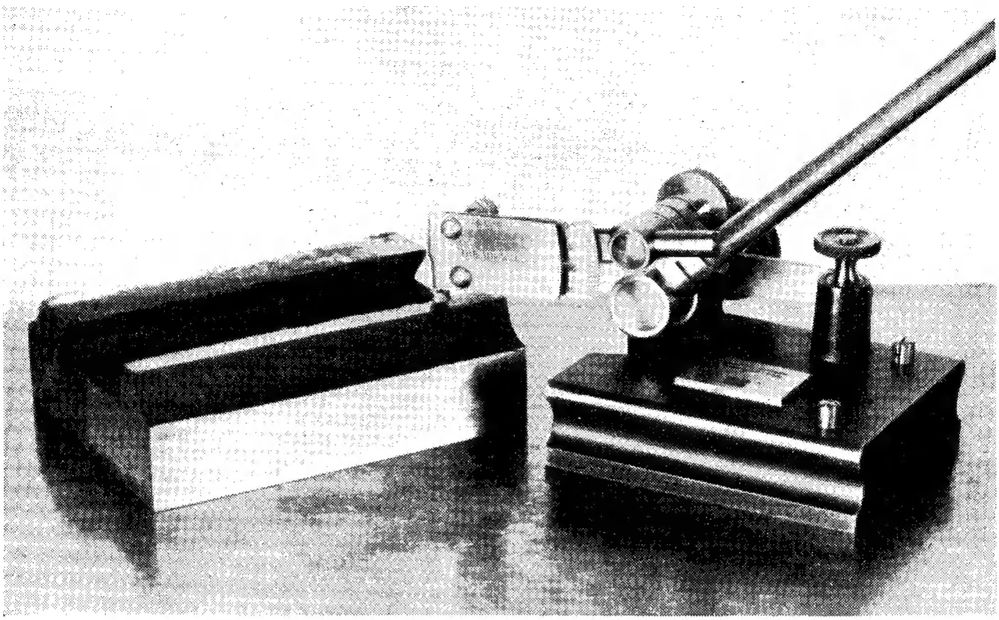


Fig. 6. Testing the parallelism of a bearing surface

and any variation shown on the scale is noted as the cross-slide is fed inwards. Any error of alignment is then corrected by slackening the clamping-nut of the vertical slide base, and rotating the slide as a whole by tapping it with a rawhide mallet. This process is continued until the reading of the test indicator does not vary with the movement of the cross-slide. A final check should be made after the vertical slide has been firmly clamped in place. To align the upper surface of the work, the test indicator, as illustrated in Fig. 3, is applied in the same way, but, here, the alignment is adjusted by slackening the nut clamping the swivel mounting of the vertical slide, and then tapping the slide to alter its vertical setting. It may sometimes be found preferable to align the machine vice itself so that several pieces of work held one at a time in the vice can be machined parallel. To do this, the test indicator is used first to set the work face of the vice in correct alignment, and the clamping surface of the fixed vice jaw is then aligned in the same way. It may, however, be found more convenient to grip a parallel strip in the vice and to use its surfaces for making the necessary settings.

Using the Test Indicator on the Surface Plate

The test indicator will serve many useful purposes when employed for aligning and checking work on the surface plate.

The correct parallel location of work resting in V-blocks may have to be checked when marking-out keyways or drilling centres, or when marking-out centre-lines on a bar. Readings are taken at either end of the bar with the test indicator, as shown in Fig. 4, and where necessary packing shims can be introduced to set the work parallel with the surface plate.

Testing Plummer Blocks

The method of testing a pair of plummer blocks is illustrated in Fig. 5. The test indicator is brought into contact with the ends of a parallel shaft fitted to the bearings, and any difference of height in the two bearing blocks can in this way be readily measured. To test the parallelism of a flat bearing surface with the base surface of the component, the part is rested on the surface plate and, as illustrated in Fig. 6, the test indicator is moved along the whole length of the surface under examination.

Although the test indicator is commonly employed to measure differences of height or length in the same component, it can also be used to make absolute measurements. For this purpose, a gauge-piece of known height, as measured with a micrometer, rests on the surface plate, and the test indicator is applied vertically to the gauge block ; the scale of the indicator is then set to zero.

If the test indicator is now brought into contact with the work, a direct reading will be obtained in thousandths of an inch of any difference between the height of the work and the exact known height of the gauge-piece.

In order to minimise the effect of any error in the test indicator itself, the height of the two measured parts should be as nearly equal as possible.

Queries and Replies

Enquiries from readers, either on technical matters directly connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a stamped, addressed envelope, and addressed "Queries and Service," THE MODEL ENGINEER, 23, Great Queen Street, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their general interest to readers, possibly by a short explanatory article in an early issue. In some cases, the letters may be published, inviting the assistance of other readers.

Where the technical information required involves the services of a specialist, or outside consultant, a fee may be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query, but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

No. 9816.—Connecting-rod Design
J.G.M. (Balcock)

Q.—I have recently drawn up some plans for an "in line" twin-cylinder two-stroke engine, and before I go ahead and produce them finally, I would like your advice on one particular point, and that is how do you determine the length of the connecting-rod (between centres). In the past I have made several petrol engines and now that I am hoping to produce one of my own for experimental purposes, the only snag I have come across is this question of the connecting-rod length. If you can help me with this information I shall be very grateful.

Does the method of application apply also to stationary steam engines?

R.—We do not know of any definite rules for determining the length of the connecting-rod in either steam or internal combustion engines. In the interests of avoiding abnormal side thrust on the cross-head or cylinder walls, it is desirable to use as long a connecting-rod as possible, but against this is the need in many cases of keeping the engine as compact as possible, and this consideration often overrules the best principles of mechanical design. It is desirable to keep the connecting-rod not less than twice the stroke in length wherever possible, but a good many small engines, both of commercial and amateur design have connecting-rods much shorter than this. Not only the mechanical efficiency but also the wearing life of the engines are often adversely affected by using too short a connecting-rod.

No. 9814.—Gearing Details
E.G. (Sheffield)

Q.—Could you please let me have some details *re* gears. (1) What exactly is D.P.? (2) How does one mark out gear centres accurately? (3) How are worm-gear ratios calculated?

R.—(1) The letters D.P. applied to gearing stand for diametral pitch, or in other words, the number of teeth in a wheel per inch of diameter measured at the pitch circle.

(2) Your query regarding marking-out your centres presumably applies to marking-out the actual distances on the machine itself, and not on a drawing. This will depend on the degree of precision which is necessary; for machines working at comparatively low speed and duty or of large size, it may be quite satisfactory to set out the gear centres by measurement with ordinary measuring tools such as steel rule and dividers, but for high precision gearing, much closer accuracy may be necessary, and the methods used in jig and tool construction, such as the use of slip gauges, may be found desirable.

(3) The gear ratio obtainable, with worm gears depends on the number of teeth in the worm wheel divided by the number of teeth or "starts" in the worm. Thus, a wormwheel of 60 teeth meshing with a 3-start worm, will give a reduction ratio of 20-1.

No. 9770.—Glow Plugs
S.L.H. (Hexham)

Q.—Could you please give me any information on glow plugs:

(1) Where can they be obtained?
(2) What provision is made for the advance of the ignition (if any)?
(3) Are special fuels or compressions used?
(4) Is the method of heating the "element" by battery.

I would also be grateful if you could inform me the approximate pressure inside a petrol i.c. engine cylinder at the time of the ignition, also the approximate pressure when exhausting.

R.—(1) These plugs are made by several manufacturers, including the K.L.G. Sparking Plug Co., and are obtainable from most model dealers.

(2) The glow-plug is not "timed" in the sense that the ordinary sparking-plug is, and the time at which ignition takes place is governed by several factors, including the "reach" of the plug or its electrode, the compression ratio and the type of fuel used.

(3) Engines with glow-plug ignition will not run on ordinary petrol, but an alcohol fuel, such as methanol which gives fairly good results. For maximum power with this type of ignition, however, special fuels are used, including compounds which are extremely difficult to obtain

in this country, the most common of which is nitromethane, added in a very small proportion to the methanol fuel.

(4) The glow-plug element is heated by battery current for starting only. When once the engine is running normally, the battery can be completely disconnected and the plug is then kept hot by the heat of combustion in the cylinder.

The combustion pressure inside a petrol engine is usually approximately three times the compression pressure, though this may vary considerably, according to the type of fuel used. The pressure at the instant the exhaust valve or port opens is entirely indeterminate, depending on details of design, and it is extremely difficult to measure in an engine running at high speed.

PRACTICAL LETTERS

"Surplus" Vacuum Pumps

DEAR SIR,—We have, in the past, been grateful for your advice on engineering queries and feel that we may be of service to you in respect of querist R.J.L. (Hereford) on the above subject in the April 27th issue.

The rotary vane type vacuum pump can be used with a special "bleeder" spray-gun and Messrs. Volspray Ltd., of Grosvenor Gardens House, Grosvenor Gardens, S.W.1, supply a suitable model called the "Airflow" with three sizes of jets from 1.8 mm. down to 0.8 mm. Messrs. Air Industrial Developments are also considering a similar gun, but this may not be in actual production yet. It would be necessary to check on maximum air displacement of vane pump, which should not be less than 4.25 c.f.m.

Oil supply for the vanes can be supplied by attaching an oil reservoir with wick, simply fixed above vane chamber and a small hole drilled to vane casing. Messrs. Shell Mex Ltd. supply a special oil for this purpose. The small rotary type pumps are usually supplied with a loose felt air-cleaning pad on the inlet side, and a similar detachable pad on the outlet side would prevent oil passing over into paint line, if cleaned regularly. The principle of bleeder-type gun is that air is passed from pump directly through gun out of two orifices above and below jet. Release of trigger allows gravity flow of paint to be atomised on contact with air stream. The question of storage does not therefore apply, and a few seconds' running of pump, before releasing gun, will dispel any accumulated lubricating oil in line.

While the bleeder-type gun mentioned above is vastly superior to the vacuum cleaner attachments, and is suitable for decorative work generally, it is not regarded as a suitable instrument for fine finishing such as automobile work, and is utterly useless for model finishing.

If your querist is considering spray plant for model work, he will need the small type of adjustable high-pressure gun. Over a period of years in which we have been engaged in finishing exhibition models for the trade we have found that two sizes of equipment are essential—one for miniature items and the other for articles up to 3 ft. super, with of course, a larger equipment for general use. The high pressure outfits permit of very fine adjustment, and with the aid of "mist" coats, a scale lustre finish can be obtained by levelling, which does not obscure fine detail work; as against the ghastly out-of-scale sticky gloss which so frequently mars an otherwise excellent model.

We quite recently made up a miniature set with the aid of a Packard war surplus compressor which cost little to build and has proved very satisfactory in use. Should your querist require information on this subject, we shall feel pleased to furnish particulars.

Yours faithfully,
Saltdean. p.p. TURNER BROS.,
N. E. TURNER.

The Penzance Traction Engine

DEAR SIR,—I was much interested to see the photograph of the Ruston compound traction engine in your issue of May 4th. I have not seen one of these engines since 1908. If as stated by Mr. Banfield this engine was made in 1903, it was built by Ruston, Proctor & Co., Sheaf Ironworks, Lincoln. I do not know the date of the amalgamation of Ruston, Proctor, and R. Hornsby of Grantham, but I think it was subsequent to the 1914-18 war.

In 1908, when living in Devon, I well remember a new threshing set, consisting of $8\frac{1}{2}$-ton engine of about 6 h.p., and steel framed threshing machine. This set was painted and finished in a very elaborate manner, and bore a garland stating that it had won an award at the Royal Agricultural Society show at Lincoln, 1907. This, I think, was the actual set that was exhibited at the show. It gave many years of good service. This single-cylinder engine had several features in common with engines by Ransomes, Sims & Jefferies, including flywheel with dished spokes, diagonal pump driven by eccentric on crankshaft outside the hornplates, and vertical regulator lever.

I was also interested in Mr. Wilkinson's splendid model portable. Here I was struck by the very heavy proportions of the flywheel. It seems to dominate the whole engine. I have had a great deal to do with traction engines, steam rollers, and portables of various makes. Until I deserted steam for internal combustion (which I have often regretted) I was a mechanic on repair and maintainance of steam tackle. If the flywheel rim of Mr. Wilkinson's engine was one-half the thickness it would still be on the heavy side. The spokes also seem unduly massive. Perhaps this may seem carping criticism, but the flywheel of an engine is very conspicuous and can easily spoil a magnificent model. I

know there was great variation in these proportions on portables, but I have never seen one quite so hefty.

Yours faithfully,
Marlborough. H. P. SNELL.

Stationary Steam Engines

DEAR SIR,—I would like to support F.W.C.'s letter in your issue of April 27th on the subject of "Stationary Steam Engines."

I am sure that if this field is reopened it would give a great deal of satisfaction to many of your subscribers.

My mind goes back 40-50 years ago to the beautiful design then published in THE MODEL ENGINEER (when in the good old days the drawings were in colour) for a Marshall undertype stationary engine. If this could be revived I am certain it would create a lot of interest.

Yours faithfully,
Sheffield. V. E. UPTON.

Rust Remover

DEAR SIR,—Your enquirer should use a solution of phosphoric acid in water, the proportions being 1 part of acid to 3 parts of water. Make sure that the acid when bought is neat—I believe it is commonly sold as a 10 per cent. solution which is too weak and quite useless for rust removal.

The articles to be treated may be placed in the solution if small enough, or the solution can be painted on with a brush until all signs of rust are gone. It must be understood that it is impossible to remove the pitting caused by the rust, and the action seems to be that of dissolving the rust, but I am unacquainted with the precise chemical reactions.

Incidentally, phosphoric acid is a flux for the soft-soldering of stainless-steel.

Yours faithfully,
Croydon. L. A. WATSON.

International Racing

DEAR SIR,—At the risk of prolonging a series of letters which should have ceased many months ago, I feel that Mr. Buck's latest letter cannot be allowed to go without comment. No one doubts Mr. Buck's sincerity in his desire to see the introduction of certain rules to model racing car competitions, but it would appear that the FACTS he quotes are open to another interpretation when viewed in the light of certain additional FACTS which he does not mention.

Throughout Mr. Buck's letter the reader is left to infer that the "guinea pig" is a standard American car and engine, such as anyone can buy over the counter in the U.S., in either kit or complete form, and that it is in fact similar to a number of cars which have been run in this country during the past season or so. If, however, I have the right car in mind, is it not a FACT that this particular car was built (not from a kit) by one of Sweden's foremost model racing car exponents, and also that the engine, far from being a "stock" model, had been modified to such an extent that few, if any, of the parts remained as manufactured? In addition, had this car not done a considerable amount of running, in the hands of its builder, both in Sweden and in this country, during which one presumes that the previous owner would have been to some considerable trouble to experiment and ascertain the correct settings and generally "work the bugs out"?

If this is correct (and I am not the only one to believe it so), then certainly neither Mr. Buck nor the engine manufacturers are entitled to any great credit, *but* the builder and tuner *is* fully entitled to a great amount of credit for an excellent job; this latter is the only fact that has been proved.

Turning to the statement: "I ran this for the first time . . . etc.," Mr. Buck appears to have forgotten the statement he made (in an attempt to prove the same point) at Liverpool, that he had run it at Rists, "and it promptly did 106 m.p.h."

The comment that the M.C.A. "rejected the proposal for two classes," appears to warrant a little clarification. At the previous M.C.A. meeting this proposal was brought up, and it was at my instigation that no decision was then taken, as I contended that I was not empowered to vote on such a controversial matter without reference to my club, but that it should be put on the agenda sent to all clubs before the next meeting, and so give them the opportunity of discussing it and registering their views. All clubs, therefore, had the opportunity of voting on the proposal, and even if they were unable to send a delegate to the meeting, surely even the smallest club can afford 2½d. for a stamp and could have sent a vote in, one way or another, had they wished to do so. Many people seem to forget that the M.C.A. is composed of clubs' representatives and is not a body of unattached individuals sitting in judgment. The proposals are passed or rejected *by the clubs themselves*, and the onus is on them either to be represented or to let the honorary secretary of the M.C.A. have their views by post. This latter is not a perfect way of doing the job, but it is surely better than blank indifference.

I will end by expressing a plea that all factions of the model car fraternity, whether "model engineers" or "table-top" exponents, should make a real effort to bury their differences and try to live together in peace. I think we all know one another's views pretty well inside out by now, and it would seem that no one has much to complain about—records are split into British and British Open, and, judging by the rules of the two open days seen so far this season, clubs seem to be taking the M.C.A. recommendations on the splitting of the classes. Anyway, it is the decision of the clubs themselves.

This antipathy between the various "cults" has already gone on far too long and already to my knowledge more than a few enthusiasts, of both "model engineer" and "table top" variety, have left the ranks, *not* because of the merits or demerits of the "home-made" or "commercial" argument, but because they said "if *this* is the spirit of British sportsmanship, then I'm not interested." Unless we all grant that the other person has a point of view, and exercise tolerance, then this drift will continue.

Yours faithfully,
Derby. IAN W. MOORE.